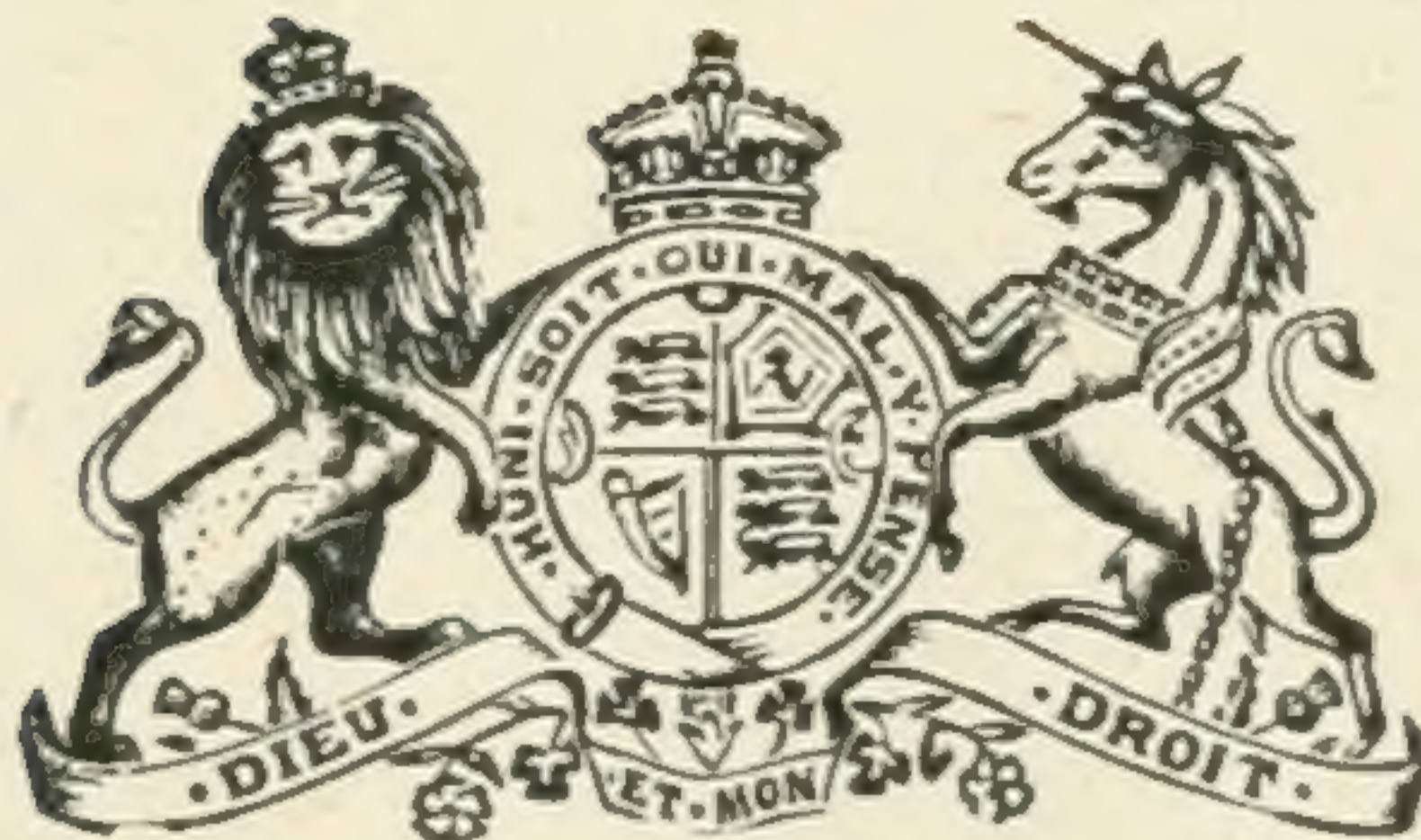


REPORT
OF THE
DEPARTMENT OF THE NAVAL SERVICE

FOR THE
FISCAL YEAR ENDING MARCH 31, 1916

PRINTED BY ORDER OF PARLIAMENT.



OTTAWA
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PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1916

*To Field Marshal, His Royal Highness Prince Arthur William Patrick Albert,
Duke of Connaught and of Strathearn, K.G., K.T., K.P., etc., etc., etc., etc.,
Governor General and Commander in Chief of the Dominion of Canada.*

MAY IT PLEASE YOUR ROYAL HIGHNESS:

I have the honour to submit herewith for the information of Your Royal Highness and the Parliament of Canada, the Sixth Annual Report of the Department of the Naval Service, being for the year ended March 31, 1916, except the Fisheries Branch, reported in a separate publication.

I have the honour to be,

Your Royal Highness's most obedient servant,

J. D. HAZEN,

Minister of the Naval Service.

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REPORT
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OTTAWA, June 23, 1916.

Honourable J. D. HAZEN,
Minister of the Naval Service,
Ottawa, Ont.

SIR,—I have the honour to report on the Department of the Naval Service for the year ending March 31, 1916, under the following headings:—

1. Naval Service.
2. Stores.
3. Fisheries Protection.
4. Survey of Tides and Currents.
5. Hydrographic Survey.
6. Canadian Arctic Expedition.
7. Life Saving Service.
8. Radio Telegraphs.

I.—NAVAL SERVICE.

H.M.C. NAVY.

During the past year the requisite number of the personnel for manning H.M.C. Ships and Establishments has been maintained by the entry of men with previous naval experience and by the employment of R.N.C.V.R. officers and men.

H.M.C.S. *Niobe* was employed, under the command of the Rear Admiral Commanding, North American Station, until September, 1915, when, owing to the very considerable amount of almost continual steaming that she had done since the outbreak of the war, it was considered that the general state of the machinery and boilers would not warrant her continuance of this duty. As a depot ship was

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urgently needed at Halifax to accommodate numerous drafts of men, and as a parent ship for the vessels employed on patrol work and other operations on the Atlantic coast was urgently required it was decided to pay the *Niobe* off and recommission her for the purposes indicated. Throughout the remainder of the year she proved suitable for her new functions, and of considerable utility both in connection with the Canadian and the Imperial services.

H.M.C.S. *Rainbow* has been continuously employed on the Pacific Coast patrol and other important duties, under the orders of the Imperial Senior Naval Officer at Esquimalt.

Submarines *C. C. I.* and *C. C. II.* and their parent ship, H.M.C.S. *Shearwater* (Submarine Depot) have been continuously employed in connection with the defence scheme of the Pacific coast.

A large number of other vessels, both governmental and private, have been utilized in connection with the defence of the coasts, on such duties as examination service, mine sweeping, patrol and other necessary work.

The Naval Volunteers, which were established just prior to the outbreak of the war, developed largely in the West, where some 400 officers and men are enrolled. A considerable number of these volunteers have served continuously in the *Rainbow* and in other vessels based on Esquimalt since the outbreak of the war. Their services are also being utilized in the various services on the Atlantic coast.

RECRUITING—ADMIRALTY.

In April, 1915, the Admiralty requested the department to select men to be trained as pilots for the Royal Naval Air Service. The department received hundreds of applications for entry from all parts of the Dominion. These applications were given individual attention and likely candidates were interviewed and medically examined. All those accepted were sent to private flying schools to obtain their Aero Club certificates, and upon obtaining them were sent to England. Although the number originally called for by the Admiralty was twice increased, the department was able to obtain the necessary number of suitable candidates, the majority of whom have already obtained their Aero Club certificates and been sent to England. The total number accepted during the year is two hundred and fifty.

The department has recently been requested by the Admiralty to ascertain what men could be entered for the Auxiliary Patrol (Motor Boat) Service. Several hundred applications have been received, and these have been classified, pending the arrival of the recruiting committee from England, who will take up the work of examining the applicants and making final selections.

NAVAL INTELLIGENCE BRANCH.

The duties and work carried out by the Naval Intelligence Branch of the department have increased considerably in magnitude and importance and have been performed in a very satisfactory manner during the past year.

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NAVAL DOCKYARDS.

With respect to the Naval Dockyards, both establishments have been worked to the full output, a considerable amount of overtime having been worked. The nature of the work done has been practically all repairs.

Halifax is being used as the base for vessels of the North Atlantic fleet which has been lately strengthened; the dockyard is being used for carrying out repairs to these vessels and keeping them in going order. No. 4 jetty has been repaired and lengthened so that it will now accommodate large ships. A contract has been placed for a 30-ton steam wharf crane for use on this jetty with a view to having available suitable lifting appliance for hoisting out damaged parts of warships should the necessity arise. The *Niobe* has been fitted up as a very efficient receiving ship.

At Esquimalt yard the expenditure and personnel have risen correspondingly, and work has been carried out on Imperial and Allied vessels, as well as those of the Canadian Service. The total amount of money paid per month in wages for the two yards is approximately 300 per cent more than that customary to be paid for the same period prior to the war.

In addition to the repairs to the vessels of the fighting fleet, the dockyards are carrying out the large number of small items of repairs needed to the various vessels now employed for auxiliary purposes for patrol and other defensive work of the coasts.

Having regard to the facilities available, this work has been carried out satisfactorily. Considerable overtime has been necessary in order to expedite the completion of the repairs.

Subsidiary work in the nature of repairs and refits of the various vessels belonging to the different branches of the Naval Service have been undertaken during the year, and repairs of vessels of other departments of the Government have also been effected. Repairs to buildings and plant incidental to the upkeep of the establishment in accordance with conditions of transfer have also been completed.

The officers and staff of the dockyards have carried out their duties in a zealous and conscientious manner, which has enabled the urgent work necessary in these yards during the period of the war to be satisfactorily and expeditiously completed.

ROYAL NAVAL COLLEGE.

The Officers of the Royal Naval College continue to report most favourably on the cadets, both as to their mental and physical progress during the past year.

The midshipmen who have been serving in ships of the Royal Navy and Royal Canadian Navy have also been favourably reported upon and have proved themselves capable and efficient. Fourteen midshipmen, who entered the college in January, 1911, were promoted to the rank of Acting Sub-Lieutenant on December 1, 1915. Two of these officers are now serving in the British Submarine Service, and four Lieutenants and five Engineer Lieutenants are serving in vessels of the Grand Fleet.

An examination for the entry of cadets to the college was held in May, 1915, and out of eight candidates six were entered.

The report of Vice-Admiral C. E. Kingsmill on the Naval Service may be found at page 28.

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II.—STORES BRANCH.

The Stores Branch of the Department of the Naval Service is divided into three sections as follows:—Purchasing and Contract section, Stores section, Transport section.

PURCHASING AND CONTRACT SECTION.

The Purchasing and Contract section has in its charge all purchases and contracts, including chartering of vessels, contracts for the erection of buildings and all installations in connection therewith, victualling of ships' crews not victualled by the department, and the purchase of all necessary stores and supplies of every description; not only the Naval Service proper but all the other branches of this Department are served.

In order to carry out the work in an efficient manner, an estimate of the requirements for the year is made out by each Ship and Establishment at the beginning of the year, and a stock adequate to meet the requirements is stored at Halifax and Esquimalt; supplementary requisitions are then filled in through the year as required.

It is the duty of the Purchasing and Contract section to call for tenders for all supplies necessary to keep up these stores. During the past year all the supplies requisite were obtained by this branch, those embodying small amounts being purchased locally where required. All ordnance stores and ammunition were procured from the Imperial Government.

During the past year purchases to the extent of \$2,485,269 were made, of which Naval stores, including coal both for the Canadian and the Imperial ships and transports, amounted to \$1,913,766.

STORES SECTION.

The activities of the Stores section depends largely upon the demand for supplies. It is the duty of this branch to ascertain that the supplies on hand are up to requirements and that a shortage therein does not occur.

The Stores section attends to supplies not only for the ships of the Naval Service but also for nine ships of the Fisheries Protection Service, Fisheries Patrol boats, six Hydrographic Survey vessels, Royal Naval Canadian Volunteer Reserve, Radiotelegraph service, Life-saving service, fish hatcheries and other fishery establishments throughout the Dominion.

The requirements for Naval purposes have increased greatly since the beginning of the war, particularly in supplies for the dockyards, where manufacture and repair work is being carried on continuously.

In addition to the above, this section also provides to a large extent for the Imperial ships stationed on Halifax and Esquimalt and for transports.

Supply depots are maintained at both Halifax and Esquimalt dockyards. Experienced store officers supervise the work and are responsible to headquarters for the proper carrying out of their duties.

As large reserves of stores are necessary in order to meet requirements of ships and establishments at the present time, it was necessary during the past year to increase the amount of stores on hand. At the commencement of the year the value

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of stores at Halifax was \$376,000, and at the end of the year the stores totalled in value \$504,763. At Esquimalt \$280,000 worth of stock was on hand at the beginning of the year, and \$298,532 worth at the end of the year.

At the commencement of the year, requisitions are prepared by the Store officers covering, as far as possible, all the requirements for the maintenance of reserve supplies during the year. Supplementary requisitions are submitted throughout the year for any unforeseen requirements.

At Halifax, during the past year, 97,421 tons of coal were handled, and at Esquimalt 26,129 tons. Supply depots were also maintained at outlying points during the past year for the convenience of vessels engaged in the Gulf of St. Lawrence patrol and for outlying establishments.

TRANSPORT SECTION.

Shortly after the outbreak of war, owing to the necessity of utilizing all available tonnage and to cope with the traffic, this department undertook to supply the empty Admiralty colliers with cargoes for European ports. This scheme gradually developed into the present organization under which this department, in conjunction with Mr. A. H. Harris, Acting Director Overseas Transport, is enabled to ship thousands of tons of material daily from all ports of Canada to the allied nations. The sailings of this service now average more than one a day. By the co-operation of the different railway companies throughout Canada the service has gradually improved until at present no difficulty or congestion of traffic is experienced, as the immense quantities of freight are directed to one or another Canadian port for shipment.

Through the courtesy of the Canadian Pacific Railway Company, their docking facilities at the different ports have been placed at the service of the Overseas Transport. This has proven of great advantage and has aided considerably in rendering the transport service most efficient.

A statement, showing the growth of the Transport Service, and also a statement of disbursement accounts of Overseas Transport Service for the past fiscal year may be found in the report of Mr. J. A. Wilson, Director of Stores, at page 30.

III.—FISHERIES PROTECTION SERVICE.

The following vessels belonging to the Fisheries Protection Service were in commission during the past year:—

EAST COAST—*Canada, Constance, Curlew, Petrel, Gulnare.*

GREAT LAKES.—*Vigilant.*

WEST COAST.—*Malaspina, Galiano, Restless, Newington.*

During the year the *Canada* was on active naval service and was, therefore, not available for Fisheries Protection duties.

The *Curlew* patrolled the bay of Fundy and west coast of Nova Scotia, following the American fishing fleet to prevent fishing within the three-mile limit. When not occupied on this service she was utilized at Halifax in connection with naval operations.

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The *Constance* was engaged on naval duties throughout the year, with the exception of a short cruise on Fisheries Protection work during December.

The *Petrel* was engaged during the year on naval work as well as on Fisheries Protection duties. She was also utilized by the Director of the Naval Service in carrying out inspections of life-saving stations. This vessel rendered assistance on several occasions to vessels in distress.

The *Gulnare* was engaged throughout the year on naval duties and was not available for Fisheries Protection service.

The *Vigilant* was commissioned on the 1st April, 1915, and at once proceeded to the west end of lake Erie to patrol the fishing grounds. The vessel was also used at different times throughout the year to inspect the life-saving stations on the Great Lakes. She continued throughout the season to carry on the patrol work to enforce the international fisheries regulations. During the year this vessel steamed 3,751 miles and seized 1,531 fishing nets, which were sold by public auction.

The *Malaspina* was engaged in Fisheries Protection duties as well as on Examination Service in connection with naval operations at Esquimalt.

The *Galiano* was also utilized at different periods in naval work and when her services were not required at Esquimalt she proceeded on her regular Fisheries Protection duties.

The *Restless* and *Newington* were both engaged on naval service continuously and were unavailable for Fisheries Protection work.

The report of Vice-Admiral C. E. Kingsmill on the Fisheries Protection service is appended at page 36.

IV.—TIDAL AND CURRENT SURVEY.

The Tidal and Current Survey Branch has for its object the investigation of tides and currents, and the publication of the information obtained to aid navigation in waters where the movements of tides and currents were previously unknown. For this purpose tide stations were established at carefully selected points along the coasts, where observations are taken. From these observations the behaviour of the tides and currents is determined and reduced to governing laws. By obtaining this information for a sufficient period, the officers of the branch are able to predict scientifically the tides of the future; and to prepare tide tables for the principal stations or ports of reference, and for the turn of the tidal streams. The tides at the harbours throughout each region are brought into relation with these principal stations; so that the tides in any locality can be readily found with reference to the tide tables. The investigations already made afford information for the time and variations of tides and currents for the greater portion of the navigable waters of the Dominion. The results of the investigations and the tidal predictions are published yearly in the "Tide Tables" which are issued well in advance of the year for which they are made out.

In addition to the regular work of the branch, the question of mean sea-level is given careful attention. From the earliest days it was realized that this information would be indispensable as a basis for extended levelling. It has now proved so, to

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the Department of Public Works and to the Geodetic Survey in connection with their levelling operations. As the levels determined by the Tidal Survey have been preserved by reference to bench marks which were established at all points where tidal stations have been operated, the information required was readily available by reference to these. Had this not been foreseen, the work of the other departments would have suffered serious delays in obtaining this basis.

During the past year, a similar basis has been provided for the extended levels which are being carried on over the railway system of Prince Edward island. The accurate value of mean sea-level at Charlottetown which has been determined by the Tidal Survey from five years of continuous observation, was utilized for this purpose. Another province has thus been placed on a satisfactory basis as regards its levels.

Similar information has been obtained and supplied for Hudson bay in connection with the line of levels carried from Winnipeg by the Surveys Branch of the Interior Department.

Investigations of the currents were carried on in important navigable waters on both the eastern and western coasts during the past year. On the eastern coast, the Grand Narrows and Bras d'Or lakes on the route from Halifax to Sydney were given particular attention, as well as the gut of Canso. The complex tidal and current irregularities in these waters have, as a result, been reduced to law and referred to established stations. The true relation of the current to the time of the tide will be obtained from the tide tables for the coming year.

Important work has also been carried on in the Saguenay district. This district is rapidly growing in importance as an industrial centre. After exhaustive observations had been taken, comparisons with Quebec and Father Point were made, so that the time of high water and the depth of water available may be obtained. The results of these investigations will be published in the tide tables.

The work on the western coast was no less successful. Five principal tide stations were maintained in continuous operation throughout the year. Observations were also taken at Caulfeilds in the strait of Georgia, to supplement the information given for that region in the tide tables. The observations were also utilized for comparison with the time of slack water in the passes investigated during 1914 and 1915.

Investigation of the currents was carried on at Dodd narrows, in Gabriola pass and Porlier pass. Owing to the force of the current through these narrow passages, the towing of lumber and coal, as well as ordinary navigation, are limited to the time of slack water. The object of the work is to obtain data by which the time of slack water can be correctly predicted. The information of this nature given in the tide tables already covers the two most important passes, namely Active pass and Seymour narrows, and is being continually added to.

Much has been done during the year in the improvement of the methods of calculation for these passes and narrows. The relations between slack water and the time of the tide have been scrutinized; and further light on the various methods which give best results under different conditions has been obtained as the investiga-

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tions proceed. The outcome is an improvement in the basis of calculation by which greater accuracy is secured for future years.

The work in Hudson bay has been continued during the past year. The results have been most useful to the Department of Railways and Canals in connection with the work on the terminal of the Hudson Bay railway at Port Nelson. Both there and in James bay, great assistance has been received by co-operation with other surveys. The department supplies these surveys with tide registering instruments which they supervise. The information obtained is eventually handed over to the Tidal and Current Survey when it has served their own purposes. Such co-operation has also been arranged on the St. Lawrence and in British Columbia.

Advance information with reference to the tides, and slack water, is supplied to manufacturing and shipping interests for their information before it can be published in the tide tables.

The demand for tide tables is continually growing. Besides their direct service to mariners, they are of great value to business concerns and fishermen who require to know the time of the tide, or the behaviour of the different tidal currents along the coast. The demand for the Pacific Coast tide tables required an issue of 15,000 copies. An abridged edition giving the tide tables for Vancouver and the strait of Georgia is also widely circulated and requires 10,000 copies to supply the demand.

The tide tables for the eastern coast are also greatly in demand, 8,000 copies being required. Pocket editions of the tide tables for Eastern Canada are also published in two sets, one for St. John and the bay of Fundy and another for Quebec and the St. Lawrence. The edition is found very useful on account of its convenient size. A total issue of 18,000 copies of these two publications is now necessary. All editions of the tide tables are supplied upon request, free of charge.

The report of Dr. W. Bell Dawson, Superintendent of the Tidal and Current Survey is appended at page 41.

V.—HYDROGRAPHIC SURVEY.

During the past year the work of the Hydrographic Survey Branch was carried out in the following districts:—Halifax harbour and approaches; Queen Charlotte islands; St. Lawrence river; lake Ontario; lake Superior; James bay. Automatic gauges were also maintained throughout the year in the Great Lakes and St. Lawrence river.

Owing to complaints both from the officers of the Royal Navy and the Merchant Marine that the soundings in the approaches to Halifax harbour were inaccurate, a survey party in charge of Capt. F. Anderson was sent in C.G.S. *Acadia* to examine the offshore conditions in that vicinity. The area between Sambro island and Egg island and for a distance of twenty miles offshore was carefully surveyed. No shoals were located, but the contour lines were closely charted and show slight variations from the old ones.

The improvements to Halifax harbour were also surveyed, and the results will be communicated to the Admiralty for the correction of their plans of the harbour. In addition to this work the party also established a "measured mile" in Bedford

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basin for the use of the dockyard officials. A Canadian chart showing the results of the survey will be issued.

In addition to the regular work of the survey the *Acadia* was used in connection with the fishery investigation conducted by Dr. Hjort. Two trips between Halifax and Newfoundland were made in this connection during the season.

The surveys in the vicinity of Queen Charlotte islands were carried out by a party in charge of Lt.-Commander P. C. Musgrave in C.G.S. *Lilloett*. Before taking up the regular work in that vicinity, however, a survey of Fisherman bay, at the north end of Vancouver island was made. Similar work was also carried out at Milbank sound, and the approaches to the Skeena river were examined. The party then proceeded to the Queen Charlotte islands. A member of the Geodetic Survey accompanied them for the purpose of selecting a point for the main triangulation along that coast.

The survey of the east side of Queen Charlotte islands between Rose spit and Cumshewa head for a distance of ten miles offshore was completed, and the survey of the coast line of Graham island was extended from Frederick island to port Lewis. An examination of Skidegate inlet was also made to the west end of East narrows and buoys and beacons were placed in the channel for the Department of Marine. Soundings were taken in Dixon entrance and between Fan island and White rock at the entrance of Browning entrance.

During the season, 90 miles of coast line were surveyed, 276 square miles were sounded and 930 linear miles of sounding were done from the ship and boats by the survey party.

The weather in this district owing to rain and fog is the cause of much loss of time in carrying on the surveys. During the past season twenty-six days were lost through rain and the party were able to work only 80 out of 186 working days.

Mr. Charles Savary in charge of a party in C.G.S. *Cartier* carried out survey work in the St. Lawrence river between Matane and cape Chat on the south shore and pointe des Monts on the north shore. The work in this area is now completed and a chart giving the results of the work will be published. During the past season this party traversed 90 miles of shore line and took 1,000 miles of soundings from the deck of the ship and from boats.

A survey was also made at Chicoutimi and the position of buoys was noted for entry on the new chart of this area about to be published. During the winter of 1914-15 the *Cartier* was used for examination service and it was not ready for service under the Hydrographic Survey until June. This delay shortened the season considerably for the St. Lawrence party.

The survey of lake Ontario was in charge of Mr. G. A. Bachand with a party in C.G.S. *Bayfield*. The survey of the west end of lake Ontario, Hamilton bay, Port Dalhousie, Port Credit, Oakville, and Bronte harbours was completed. This completes the work at the west end of the lake and charts of the whole area and of the harbours mentioned will be published shortly.

In the latter part of the season a survey of Kingston harbour and approaches was begun. The work will be completed during the coming season. During the year

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90 miles of traversing were done and 460 miles of sounding from boats and 280 miles from the deck of the ship were taken.

Mr. H. D. Parizeau with a survey party in C.G.S. *La Canadienne* carried out the work of this branch in lake Superior. A survey was carried on at Owen Sound and Byng inlet. The work begun the previous year at the latter place was completed, and a chart giving the results of the work is under preparation. An inspection of buoys at Little Current was made so that they might be in accordance with the chart recently issued.

The main work of the party was carried out between Oiseaux bay and Copper island, where off-shore soundings were taken. This work completes the survey of the north shore of lake Superior from Pigeon bay to Otter head, with the exception of Nipigon and Black bays. During the fall the triangulation of Nipigon bay was commenced. The party traversed 43 miles of coast line and sounded 624 miles from boats and 535 miles from the deck of the ship.

The James bay survey was in charge of Mr. Paul Jobin. The party proceeded to Moose Factory by way of Cochrane. At Moose Factory they chartered a small vessel for the season to carry on the work. A survey of the mouth of Moose river was completed, and a chart has been prepared. The party then surveyed the south of James bay as far as Charlton and Strutton islands. Upon the completion of this work they returned to Ottawa.

Conditions for navigation in James bay were reported to be generally good during the season. The ss. *Bonaventure* arrived at Strutton island on the 3rd August, having encountered very little ice in Hudson bay.

During the year, eleven automatic gauges were operated on the Great Lakes. On the St. Lawrence river sixteen gauges were operated. Particulars of the work in connection with the automatic gauges may be obtained from the report of the Hydrographic Survey Branch.

In addition to the regular work of the branch considerable assistance has been given to the Tidal and Current Survey. Tide-registering instruments have been maintained by the different survey parties, particularly in the St. Lawrence river and James bay, and the information obtained has been handed to the Tidal and Current Survey.

The work of the Hydrographic Survey has been carried on successfully during the past year. Several members of the survey have enlisted for active service and their absence has been keenly felt in carrying on the work.

The report of W. J. Stewart, C.E., Chief Hydrographer, is appended at 54.

VI.—CANADIAN ARCTIC EXPEDITION.

The Canadian Arctic Expedition which, for the past two years, has been attracting popular attention, has come through another year of successful exploration, and has added many interesting and instructive facts to the history of the arctic regions.

During the first year, owing to the unusual ice conditions, the expedition, which was divided into two divisions, was unable to proceed as far into the northern regions as had been planned. The southern division were prevented by the ice from following the coast further than Collinson point, Alaska, and were obliged to winter there.

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The members, nevertheless occupied their time very profitably from an expeditionary point of view and successfully carried out surveys of the coast as far as and including the Mackenzie delta. They also made a special study of the life habits of the natives in the vicinity, took tidal observations and carried out astronomical work.

The northern division were also unfortunate. The party in the C.G.S. *Karluk* were carried by drift ice far to the eastward along the north coast of Canada. Mr. Stefansson and three companions in an attempt to reach shore from that vessel, on a hunting trip to increase the supply of fresh meat, were obliged to seek shelter, during a gale, on Thetis island. While there, the vessel was carried away and the party were left on the shore with very little provisions, and with winter approaching. The explorer's great experience in northern travel, however, enabled him to reach Collinson point without any great difficulty, where he joined the southern division.

The party in the *Karluk* were carried about for four months in the ice. In January, 1914, the vessel was crushed and sunk, and the party were obliged to encamp on the ice. The short diary entries of Captain Bartlett (Naval Service Annual Report for 1915, page 22) tell more clearly than lengthy reports of the hardships encountered by the members from the time the vessel was sunk until they were finally rescued. Captain Bartlett's bravery and devotion to the members of the expedition are shown in his simple statement, "I intend to-morrow to leave with Eskimo for the Siberian coast . . . leaving the men on the island." The distance to the Siberian coast is 160 miles, across the ice, which was in a broken-up state, making travel very difficult and dangerous. He succeeded, however, in reaching shore and reported the fate of the vessel and the position of the survivors to this department. The department sent a relief expedition which succeeded in rescuing the party from Wrangel island.

Mr. Stefansson, upon his arrival at Collinson point, decided that the *Karluk* party could not be counted upon to carry out the work of the northern division. The whereabouts of the vessel and its ultimate fate were unknown to him for over a year later. Although the absence of the *Karluk*, with supplies, was a serious handicap, he did not hesitate to adopt the one remaining course open for the exploration of Beaufort sea, that is, a journey on foot over the ice. He made all preparations and on March 22, 1914, accompanied by two men, he set out on foot over Beaufort sea. His objective was Banks island. On the journey from Martin point he made every effort to cover as much as possible of the little known areas of Beaufort sea west of Banks island. He continued his research on the sea ice until their food supplies became so low that they were obliged to live on limited rations, and were depending upon loose cakes of ice to carry them through the open leads. The scientific investigations carried out both on this journey and afterwards on Banks island are of great value. During the journey the eminent explorer showed the greatest courage and endurance and demonstrated his devotion to the work of the expedition. The desire for further investigation induced him to remain on Banks island until the sea ice again became firm, when he set out on a journey still farther north, over the ice of Beaufort sea. This journey brought him along the west coast of Prince Patrick island and thence north to cape McClintock. Here he found a cairn in which were deposited the records of Capt. F. L. McClintock, dated 15th June, 1853.

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Captain McClintock was, at that time, carrying on investigations in the north in search of some clue as to the fate of the Franklin expedition. It is a notable fact that under practically the same circumstances Mr. Stefansson was able to carry on successfully a trip on foot over the ice, whereas the Franklin party succumbed. This is entirely due to the efficiency of modern firearms and to the great experience of Mr. Stefansson himself. He insists on all the members of his party adopting the life methods of the Eskimo while in the north, for his experience has shown him that this is the best means of combating scurvy and other diseases prevalent in the northern regions.

Upon leaving cape McClintock the party followed a course about northeast by east for three days, when new land was sighted. During the time they remained in the vicinity of this new land the weather was so foggy that they were unable to obtain reliable readings for its exact location. The land, from what they saw of it, was of considerable size, hills and mountains appearing particularly to the northeastward, at a great distance. It is hoped that during the winter of 1915-16 the party were able to obtain much more definite information with reference to their discovery.

As by the time they reached the new land the season was well advanced and the summer of 1915 was fast approaching, they were obliged to hasten south to Banks island. Early in August the party arrived at Kellett, Banks island, from the northern ice trip, and immediately made arrangements with a whaling vessel to be taken to the mainland. The reports forwarded to the department contain a full description of the ice journey made and the scientific work carried on.

The northern division were unable to attain the proposed base on northern Banks island but were obliged to winter at Princess Royal island, Prince of Wales strait. An ice journey was undertaken in April 1916 when Mr. Stefansson and party set out for the new land discovered last year. During the summer and fall of 1916 it was proposed to investigate thoroughly the new land working from a base at Winter Harbour, Melville island. The northern division of the expedition will probably return to civilization late in 1916 or in the summer of 1917.

The southern division left Collinson point on the 25th July, 1914, and proceeded along the north coast of Canada to the eastward until they entered Dolphin and Union strait. Here they found an ideal harbour from which operations could be carried on. This harbour was unmarked on the charts, so they named it Bernard harbour. It is situated on the south shore of Dolphin and Union strait, about midway between cape Bexley and cape Krusenstern.

Using Bernard harbour as a base, the party have been carrying on survey work along the coast and also investigating the mineral deposits between cape Parry and Kent peninsula during the past two seasons. The habits of the Eskimos of the eastern regions, which, prior to Mr. Stefansson's expedition and life among them between 1908-13, were very little, if at all, known, were given further study, and many new facts with reference to them were brought to light.

The southern shore of Victoria island was also visited and the ethnology of the Eskimos carefully investigated.

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The work of the southern division throughout has been most thorough, and the area allotted to them has been covered in a very complete manner. During the summer of 1916 the different surveys under way should be completed, and the expedition is to return south in the fall.

A complete report of the scientific work carried out by the different parties and also a chart of the different journeys made may be found at page 71.

VII.—LIFE-SAVING SERVICE.

The object of this service is to render assistance to the crews and passengers on ships in distress and to rescue persons from wrecked vessels along the Canadian coasts.

The Department of the Naval Service also undertakes to reward bravery in life-saving at sea. It does not, however, deal with cases of life-saving in the rivers and on the coasts; such cases should be brought to the attention of the Royal Canadian Humane Society at Hamilton, Ont.

During the past year thirty-seven life-saving stations were maintained throughout the Dominion, and the required number of drills have been performed by each station. Frequent inspections of the various stations have been made to ascertain their being in an efficient condition.

The following table gives the number of stations in each province, together with information respecting their crews:—

East Coast.

Province.	Number of Stations.	Crew.
Nova Scotia.	15,	One with a permanent crew, who live at the station throughout the year; Two with permanent crews during the season of navigation only, and Twelve with volunteer crews, who drill twice a month and are called out on the occasion of a wreck.
New Brunswick	4,	One with permanent crew; One with permanent crew during the season of navigation only, and Two with volunteer crews.
Prince Edward Island.	5,	With volunteer crews.

Great Lakes.

Province.	Number of Stations.	Crew.
Ontario	10,	Three with permanent crews during the season of navigation only, and Seven with volunteer crews.

West Coast.

Province.	Number of Stations.	Crew.
British Columbia.	3,	With permanent crews.

As motor-boats are now replacing sail-boats in many of the fishing districts, the danger of the fishermen's vessels becoming disabled is gradually diminishing. The fishermen are also able to render assistance to one another in cases of breakdown, so that in many instances it is unnecessary for the life-boats to put to sea.

Assistance was, however, rendered on many occasions to the occupants of vessels wrecked or in danger. On several occasions the vessels themselves were brought into safe anchorage.

Particulars of services rendered by individual stations are contained in the report of Vice-Admoral C. E. Kingsmill on the Life-saving Service at page 81.

VIII.—RADIOTELEGRAPH BRANCH.

During the past year the work of the Radiotelegraph Branch has been carried out in an efficient manner: 142 stations composed of Government commercial and coast stations; government ship and licensed ship stations; public and private commercial stations; training schools and licensed experimental stations, have been operated throughout the Dominion. At the commencement of the war all amateur stations in Canada were closed down.

The following stations on the East coast, formerly operated by the Marconi Wireless Telegraph Company, have been taken over and are now operated by the Department of the Naval Service: Camperdown, N.S., on the 1st May, 1915; North Sydney, N.S., on the 1st August, 1915; Point Riche, Nfld., on the 1st September, 1915; Sable island, N.S., on the 1st January, 1916.

The amount of business handled by the East Coast, Great Lakes and West Coast stations shows a decrease over last year. This decrease is directly attributable to the war and the placing of these stations on a war basis. The business at LePas and Port Nelson stations on the Hudson Bay chain shows an increase. Following is a comparative statement of business handled during 1914-15 and 1915-16:—

—	1914-15.		1915-16.		Increase or Decrease.	Messages.	Words.
	Messages.	Words.	Messages.	Words.			
East Coast.	59,846	1,196,512	45,195	864,020	Decrease. . .	14,651	332,492
Great Lakes..	15,785	326,505	13,617	259,366	" . . .	2,168	67,139
West Coast.....	98,386	1,532,526	95,048	1,103,395	" . . .	3,338	429,131
Hudson Bay	5,259	325,961	7,617	570,281	Increase. . .	2,358	244,320
Totals.....	179,276	3,381,504	161,477	2,797,062	Net decrease	17,799	584,442

The total revenue from this service during the past year amounted to \$8,494.99.

The department requires that all those entering the Radiotelegraph service as operators, pass a proficiency examination to determine their qualifications prior to acceptance. During the past fiscal year one hundred and seven operators were examined at different points throughout Canada; out of this number fifty-two were successful. Applications for entry as operators in the Radiotelegraph Service should be addressed to "The Deputy Minister, Naval Service Department, Ottawa."

On account of the confidential nature of the messages passing through the hands of radiotelegraph operators, and the secret instructions with which they must be entrusted during the present time, it was considered advisable to enlist in the Royal Naval Canadian Volunteer Reserve all the wireless operators in the employ of

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the department; for this purpose the rank of wireless operator was instituted, and regulations were drawn up to meet the requirements in this connection. The operators have now been enlisted in the R.N.C.V.R.

In addition to its regular work the Radiotelegraph Service has on many occasions been instrumental in obtaining assistance for vessels in distress and in communicating instructions from their owners.

The usual repairs to keep the different stations in an efficient condition and regular inspections of all stations were carried out during the year. The power of the North Sydney station was increased by the installation of a new transmitting apparatus of 2-k.w. power. Repairs were also carried out at Point Riche, Alert bay, Cape Lazo, Dead Tree point, Digby island, Estevan, Gonzales hill, Ikeda, Pachena, and Triangle island stations. Work has been started on the new radiotelegraph station at Mansel island; the men and material necessary to carry out the work were transported in C.G.S. *Burleigh* to Mansel island where the eight mast anchors and building foundations were installed, and construction shacks were built. Preparations for the erection of the buildings and masts are now completed. When the station is completed it will be utilized to communicate with ships entering Hudson strait and bay. By the use of this station vessels entering Hudson strait will then be able to communicate via Mansel island and Port Nelson stations with the outside world.

The department, in addition to the above-mentioned work, has equipped all munitions transports running between Canada and England with radiotelegraph apparatus and has supplied operators and supervised the operation of the stations in connection therewith. This work has been carried out on behalf of the British Admiralty, with whom an agreement has been drawn up for that purpose.

The total number of persons employed in the Radiotelegraph Branch during the past fiscal year was four hundred and four.

The branch has carried out in addition to the above a great amount of work of a confidential character in connection with the war. It is not advisable at the present time to give particulars of this work. The report of Mr. C. P. Edwards, Superintendent of the Radiotelegraph Branch, is appended at page 84.

GENERAL.

I have much pleasure in expressing my satisfaction at the efficient manner in which officers of the department have carried out their duties during the year.

I have the honour to be, sir,

Your obedient servant.

G. J. DESBARATS,
Deputy Minister.

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OTTAWA, August 10, 1916.

The Deputy Minister,
Department of Naval Service,
Ottawa, Ont.

SIR,—I have the honour to submit herewith a financial statement showing the expenditure under the various appropriations, and the revenue received by the department during the fiscal year ended March 31, 1916.

The expenditure on account of H.M.C.S. *Niobe*, H.M.C.S. *Rainbow*, submarine C.C. 1 and C.C. 2 and depot, H.M.C.S. *Shearwater* shore depot and extraordinary expenditures for the dockyards at Halifax and Esquimalt have been charged to War Appropriation. The ordinary expenditure for the up-keep and maintenance of the Royal Naval College, Halifax and Esquimalt dockyards has been charged to the Naval Service Appropriation.

A statement of stores supplied, work done and advances made on behalf of the British, French, Japanese, and Russian Governments is also submitted. These disbursements amount during the fiscal year 1915-16 to \$2,976,621.72, and to this should be added the sum of \$708,906.46 transferred from fiscal year 1914-15, thus making a grand total of \$3,685,618.18 debited against the Allies during fiscal year 1915-16. Credits and cash received during the year amount to \$2,967,217.45, leaving an outstanding balance of \$718,400.73 which is not included in the amounts charged to War or Naval Appropriations, but carried forward in suspense to the fiscal year 1916-17.

I have the honour to be, sir,
Your obedient servant,

L. J. BEAUSOLEIL,
Chief Accountant.

STATEMENT of Jobs completed in the Workshops, and Stores Supplied by the Halifax and Esquimalt Dockyards, during Fiscal Year 1915-16.

Service.	Halifax.	Esquimalt.
	\$ cts.	\$ cts.
Naval service.....	425,504 64	339,643 31
Fisheries Protection service.....	20,289 22	35,251 24
Hydrographic surveys.....	13,638 75	10,024 52
Life Saving service.....	2,478 78	356 50
Radiotelegraph service.....	7,916 05	4,090 81
Fishery Patrol service.....	6,422 11	320 59
British Admiralty.....	200,590 17	112,234 06
French.....	1,170 56	
Russian Government.....	1,325 18	
Japanese.....		2,153 84
Commonwealth of Australia.....	403 89	
Dept. of Marine.....		3,909 92
“ Militia and Defence.....		1,741 38
Sundries.....	2,692 37	2,945 96
	682,431 72	512,672 13
Wages paid.....	156,445 97	198,902 22
Salaries.....	30,655 35	34,096 66

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STATEMENT of Appropriation Accounts for Fiscal Year 1915-16.

Service.	Appropriation	Expenditure.	Balance unexpended.
	\$ cts.	\$ cts.	\$ cts.
Naval service.....	1,000,000 00	401,722 28	598,277 72
Fisheries protection service.....	375,000 00	145,241 00	229,759 00
Hydrographic surveys.....	390,000 00	231,629 42	158,370 58
Radiotelegraph service.....	350,000 00	188,358 25	161,641 75
Tidal service.....	35,000 00	16,793 23	18,206 77
Patrol of the Northern Waters of Canada.....	85,000 00	75,616 44	9,383 56
New Fisheries Protection steamers.....	30,000 00		30,000 00
Rewards for saving life, including life saving service.....	125,400 00	95,065 65	30,334 35
	2,390,400 00	1,154,426 27	1,235,973 73
<i>Fisheries—</i>			
Salaries and disbursements of fishery officers.....	305,000 00	247,539 58	57,460 42
Building fishways and clearing rivers.....	30,000 00	5,205 55	24,794 45
Legal and incidental expenses.....	4,000 00	1,138 98	2,861 02
Canadian Fisheries Museum.....	8,000 00	6,646 80	1,353 20
Oyster culture.....	6,000 00	4,470 95	1,529 05
Cold storage and transportation of fish.....	150,000 00	89,459 10	60,540 90
Dogfish reduction works.....	60,000 00	32,137 86	27,862 14
Services of customs officers <i>re Modus Vivendi</i> licenses..	900 00	439 65	460 35
Fisheries Intelligence Bureau.....	5,000 00	4,618 64	381 36
Fisheries patrol service.....	190,000 00	153,933 97	36,066 03
Exhibit of fresh and cured fish (Toronto Exhibition)...	15,000 00	10,928 97	4,071 03
Fish breeding establishments.....	400,000 00	275,079 38	124,920 62
Inspection of canned and pickled fish.....	25,000 00	12,327 75	12,672 25
Building fisheries patrol boats.....	32,000 00	21,423 10	10,576 90
Fisheries patrol steamer for Lake Winnipeg.....	100,000 00	49,212 81	50,787 19
Removal of obstructions, Fraser river.....	30,000 00	7,007 83	22,992 17
Investigation of Hudson Bay fisheries.....	10,000 00	442 17	9,557 83
Compensation to Captain Peter Carlson.....	4,500 00	4,500 00	
Marine Biological Stations and Investigations.....	26,000 00	26,000 00	
Expenses investigating claims for compensation under Pelagic Sealing Treaty.....	4,100 00	4,049 15	50 85
	1,405,500 00	956,462 24	448,937 76
Civil government salaries.....	170,600 00	150,795 81	19,804 19
Contingencies.....	50,000 00	42,869 71	7,130 29
	220,600 00	193,665 52	26,934 48
Fishing bounty.....	160,000 00	158,741 05	1,321 15
RECAPITULATION.			
Naval service.....	2,390,400 00	1,154,426 27	1,235,973 73
Fisheries.....	1,405,500 00	956,562 24	448,937 76
Civil Government.....	170,600 00	150,795 81	19,804 19
Contingencies.....	50,000 00	42,869 71	7,130 29
	4,016,500 00	2,304,654 03	1,711,845 97
Fishing bounty.....	160,000 00	158,741 05	1,321 15
War appropriation.....		3,274,019 94	
Total expenditure from appropriations, fiscal year 1915-16..		5,737,415 02	
Suspense accounts (recoverable) transferred to fiscal year 1916-17, being amount due for stores supplied and work done on behalf of the British, French, Russian govern- ments, etc.....		718,400 73	
		6,455,635 75	

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STATEMENT of Appropriation Accounts for Fiscal Year 1915-16—*Continued.*

SUSPENSE ACCOUNTS.

Amounts outstanding in respect to stores supplied, work done, and advances made, etc. at end of fiscal year 1915-16.

British Admiralty.....	\$ 607,626 16
British war office.....	26,946 46
Commonwealth of Australia.....	54,981 97
French Admiralty.....	18,205 88
Russian Government.....	6,618 65
Militia and Defence Department.....	2,014 55
Department of Marine.....	428 48
Miscellaneous.....	1,578 58
	<u>\$ 718,400 73</u>

STATEMENT of Revenue of the Department of the Naval Services for Fiscal Year ended March 31, 1916.

	\$	cts.	\$	cts.
Royal Naval College—College fees (13 cadets).....			1,300	00
Fisheries revenue.....			96,376	26
<i>Modus Vivendi</i> (licenses to United States fishing vessels).....			9,912	00
Casual revenue.....			55,185	87
Miscellaneous revenue.....			985	32
Wireless apparatus licenses.....			227	00
Wireless operators examination fees.....			119	00
Radiotelegraph revenue:—				
Alert Bay station.....	491	11		
Cape Lazo station.....	347	85		
Dada Tree station.....	413	17		
Digby Island station.....	1,429	95		
Estevan Point station.....	1,508	89		
Gonazles Hill station.....	1,810	01		
Ikeda Head station.....	86	72		
Pachena point station.....	43	25		
Point Grey station.....	340	14		
Triangle station.....	923	41		
Malaspina station.....	0	72		
Camperdown station.....	154	73		
Magdalen Islands station.....	574	57		
Kingston station.....	2	12		
Midland station.....	9	19		
Point Edward station.....	17	24		
Port Arthur station.....	12	74		
Port Burwell station.....	6	07		
Sault Ste. Marie station.....	11	02		
Tobermory station.....	3	14		
Toronto station.....	16	64	8,202	68
			<u>\$ 172,308</u>	<u>13</u>

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FISHERIES Revenue for Fiscal Year ended March 31, 1916.

Provinces.	Amount Collected.	Refunds.	Net Amount.
	\$ cts.	\$ cts.	\$ cts.
Ontario.....	2,600 65	.....	2,600 65
Quebec.....	7,006 89	.....	7,006 89
New Brunswick.....	15,098 80	1 00	15,097 80
Nova Scotia.....	7,109 18	140 00	6,969 18
Prince Edward Island.....	3,165 35	.....	3,165 35
Manitoba.....	5,926 00	.....	5,926 00
Saskatchewan.....	3,215 00	20 00	3,195 00
Alberta.....	5,237 85	.....	5,237 85
British Columbia.....	46,872 54	10 00	46,862 54
Yukon.....	315 00	.....	315 00
	\$ 96,547 26	\$ 171 00	\$ 96,376 26
Modus Vivendi licenses.....	9,912 50	0 50	9,912 00
			\$ 106,288 26

STATEMENT of Expenditure under the War Appropriation for Fiscal Year ending March 31, 1916.

Ship or Establishment.	Pay and Allowances.	Stores and Allowances.	Medical Services.	Subsistence of Prisoners.	Recruiting Expenses.	Repairs and Maintenance.	Purchase of Ships and Alterations.	Works, Lands, Buildings.	Misc. Effective Services.	Separation Allowance.	Non-Effective Pay.	Harbour Defence.	Total.
	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.
H.M.S.C. "Niobe" ..	258,671 65	264,119 19	3,046 55	190 00	8 79	39,198 29			20,984 51	47,307 90	11,319 01		644,845 92
H.M.C.S. "Rainbow" ..	108,566 58	42,269 87	1,973 90	765 95		45,131 71			6,030 69	16,060 14	13,864 29		244,664 13
Submarines and Depot	80,900 70	61,273 85	2,200 13	120 95		38,676 04			8,325 12	7,875 28	232 00		199,004 07
H.M.C.S. "Shearwater Shore Depot"	85,784 17	72,660 37	1,259 86	429 80	990 16				5,396 33	11,965 41	1,172 75		179,658 88
H.M.C.S. "Diana" (Depot) ..	47,261 29	20,997 79	1,764 41	18 50	69 17	667 91			19,345 29	9,177 10			99,301 46
H.M.C.S. "Canada" ..	33,869 92	30,031 79	1,183 35			14,435 63			2,094 12	2,979 65			84,594 46
H.M.C.S. "Margaret" ..	33,282 31	25,199 34	55 75			14,616 03			2,655 56	6,932 90			82,741 89
H.M.C.S. "Florence" ..	13,395 17	16,401 94	25 90			7,187 70			8,992 15	1,179 80			47,182 66
H.M.C.S. "Hochelaga" ..	15,343 17	19,926 63	46 50			19,650 10	92,642 18		839 57	2,539 05			150,987 20
H.M.C.S. "Stadacona" ..	14,413 27	19,797 74	106 75			7,529 14	114,986 80		702 25	1,498 90			159,034 85
H.M.C.S. "Grilse" ..	9,893 91	22,943 28	21 50			6,648 25	126,564 01		346 46	551 05			166,968 46
H.M.C.S. "Tuna" ..	3,777 08	4,633 98	6 75			3,045 25			287 26	678 75			12,432 07
Atlantic Coast Defence ..	5,624 14								3,223 90	803 20		694,666 12	704,317 36
Pacific Coast Defence ..												133,523 37	133,523 37
H.M.C.S. "Shearwater" (Ship) ..						41,077 68							41,077 68
H.M.C.S. "Protesilaus" ..		10,670 29				66 17							10,736 46
Halifax Dockyard ..		8,292 24				9,127 14		44,928 77	2,490 35				64,838 50
Esquimalt Dockyard ..		2,479 22	122 00			1,294 22			1,576 73				5,472 17
Barrington Wireless Station ..	19,853 96							39,716 19					39,716 19
Headquarters ..			238 70		6 00				7,983 98				27,837 94
General account ..		40,263 19							142,548 95	328 25	1,100 13		184,485 22
	730,637 32	661,963 71	12,052 05	1,525 20	1,074 12	248,351 26	334,192 99	81,644 96	233,823 25	109,877 41	27,688 18	828,189 49	3,274,019 91

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STATEMENT of Expenditure under the Naval Service Appropriation for Fiscal Year ending March 31, 1916.

	H.M.C.S. "Niobe".	H.M.C.S. "Rainbow".	Halifax Dockyard.	Esquimalt Dockyard.	Royal Naval College.	Head- Quarters.	General account.	Total.
	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.
Pay and allowances.....	Credit, 499 56	89 60		731 21	44,968 31	17,298 21		62,587 77
Stores and allowances.....			160,954 64	50,640 53	15,956 66	405 53	4,895 09	232,852 45
Medical services.....				5 00	191 88			196 88
Cadets misc. expenses.....					202 26			202 26
New machinery.....			12,710 81	12,549 42	1,020 14			26,280 37
Repairs to machinery.....				7,064 44	535 50			7,599 94
Repairs and maintenance of buildings.....			15,993 64	19,388 48	2,962 65			38,344 77
Misc. dockyard services.....			34,711 78	52,012 22				86,724 00
			Credit, 23,696 94	Credit, 56,270 36				Credit, 79,967 30
Percentage on stores and wages.....			3,182 67					3,182 67
New works.....			3,971 29	2,360 46	9,146 95	337 41	192 95	16,290 93
Misc. effective services.....	141 75	140 12			3,244 62		768 93	6,138 49
Non-effective pay.....	1,269 80	855 14						
			Credit, 8 92					1,631 25
Depreciation.....			Credit, 2,229 73	Credit, 964 79				Credit, 3,194 52
Arisings.....				2,852 32				2,852 32
Conversions (incomplete).....								
	911 99	1,084 86	205,589 24	92,009 10	78,228 97	18,041 15	5,856 97	401,722 28

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NAVAL SERVICE.

DEPARTMENT OF THE NAVAL SERVICE,

OTTAWA, April 1, 1916.

The Deputy Minister,
Department of the Naval Service,
Ottawa, Canada.

SIR,—I have the honour to report regarding the Naval Service, for the fiscal year ending March 31, 1916.

The progress, both mental and physical, of the cadets at the Royal Naval College at Halifax still proves most satisfactory. An examination for the entry of cadets to the college was held in May, 1915, and six cadets were entered. The officers of the college continue to report most favourably on the cadets, and the midshipmen who have been serving in ships of the Royal Navy, H.M.C. ships *Niobe*, *Rainbow*, submarine C.C.I. and C.C. 2, and patrol vessels, have also been most favourably reported upon and proved themselves capable and efficient. The fourteen midshipmen who entered the college in January, 1911, were promoted to acting sub-lieutenant on December 1, 1915. Two of these officers are now serving in the British Submarine Service. Four lieutenants and five engineer lieutenants are serving in vessels of the Grand Fleet.

The requisite number of the personnel for the manning of all H.M.C. Ships and Establishments has been maintained by the entry of men with previous naval experience, and by the employment of R.N.C.V.R. officers and men.

H.M.C.S. *Niobe* continued to be employed under the command of the Rear Admiral Commanding, North American Station, until September last, when, owing to the very considerable amount of almost continuous steaming that she had done since the outbreak of the war, it was considered that the general state of her machinery and boilers would not warrant her continuance on this duty. This fact, in conjunction with the urgent necessity of a depot ship, to be used to accommodate numerous drafts of men passing through Halifax, and of a parent ship for the vessels employed on patrol work, etc., on the Atlantic coast, caused the decision to be made to pay her off and re-commission her for the purposes indicated. Since that date, she has proved suitable for her new functions, and of considerable utility both in connection with the Canadian and Imperial services.

H.M.C.S. *Rainbow* has been continuously employed on the west coast in trade protection and other important duties, under the orders of the Imperial Senior Naval Officer of that station.

The two submarines and their parent ship, the *Shearwater*, have been actively employed for the defence of the British Columbian coasts.

A large number of other vessels, both governmental and private, are being utilized in connection with the naval defence of the coasts on such duties as examination service, mine sweeping, patrols, and other necessary work.

The Naval Volunteers which were established just previous to the outbreak of the war developed largely in the West, where some 400 officers and men are enrolled. These volunteers have done good service both ashore and afloat, a considerable number serving continuously in the *Rainbow* since the outbreak of hostilities, whilst others are in H.M.S. *Newcastle* and various vessels at Esquimalt, including the submarines and their parent ship, the *Shearwater*.

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A considerable number of R.N.C.V.R. officers and men are also employed in various ships on the East Coast.

In April, 1915, the Admiralty requested the department to select a considerable number of men to be trained as pilots for the Royal Naval Air Service. This involved a very considerable amount of work and correspondence, many hundreds of applications for entry being received from all over the Dominion. These were gone into individually, and arrangements made for interviewing and medically examining likely applicants. All those accepted then went to private flying schools to obtain their Aero Club Certificates, and, upon obtaining them, were sent to England. The number called for by the Admiralty was twice increased, but the full quota was obtained; and the great majority entered up to the present have now obtained their flying certificates and been sent to England.

Recently the department was also requested by the Admiralty to ascertain what men could be entered for the Auxiliary Patrol (Motor-boat) Service. Several hundred applications have been received, and these have been classified, pending the arrival of a recruiting committee from England, who will make final selections.

The duties and work carried out by the Naval Intelligence Department have increased considerably in magnitude and importance, and have been carried out in a very satisfactory manner.

I have the honour to be, sir,

Your obedient servant,

C. E. KINGSMILL, *Vice-Admiral,*
Director of the Naval Service.

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STORES BRANCH.

OTTAWA, July 21, 1916.

The Deputy Minister,
Department of the Naval Service,
Ottawa.

SIR,—I have the honour to submit the annual report of the Stores Branch for the fiscal year ending March 31, 1916.

In keeping with the organization of the branch, and for convenience, the report is divided into three sections:—

1. Purchasing and contract section,
2. Stores section,
3. Transportation section.

I. PURCHASING AND CONTRACT SECTION.

The duty of this section is to execute and supervise all contracts and purchases. This includes the chartering of vessels, the making of contracts for the erection of buildings and other permanent structures, for water supplies, electric light and power, telephone services, etc., for the victualling of ships crews where the victualling is not done by the department, and the purchase, by contract or otherwise, of all necessary stores and supplies of every description. In addition to the Naval Service proper, the following branches are served in this way: Hydrographic Surveys, Tidal and Current Surveys, Radiotelegraph Service, Fishery Protection Service, Fishery Patrol Service, Fish Breeding Service, other fisheries services, Life Saving Service.

As far as possible all branches utilize the stock-keeping facilities maintained at the dockyards at Halifax and Esquimalt, and draw supplies from these points. The main duty of this section is, therefore, the procuring of supplies in replenishment of stores kept there.

Demands are received from each dockyard at the commencement of each year, providing, as far as possible, for all requirements during the ensuing year. Supplementary demands are received at intervals thereafter providing for unforeseen requirements.

Demands are classified under six headings, and include: Provisions, clothing and materials, medical supplies, naval stores, consisting of lumber, metals and hardware, tools, textiles and cordage, packings and rubber goods, paints and oils, leather goods, glass, furnishings, brushes, etc., electrical supplies, and fuel; ordnance stores and ammunition, and stationery and printing.

Tenders are called for the main items by advertisement in the press. The lesser items are purchased by limited tender, *i.e.*, tenders distributed amongst known reliable firms, or in cases of special patented or proprietary articles, by direct order. Items of small value, where no benefit can be derived through purchase in the wider markets, are referred back to the dockyard for purchase locally. Certain other items, peculiar to ships of war, are obtainable, under existing conditions, only from or through the Imperial Government. These are demanded by special requisition, forwarded through the office of the High Commissioner in London. Stationery and printing is, of course, all procured through the Government Printing and Stationery Department.

As far as possible, contracts are made to call for fixed quantities, of specified make and quality, for delivery within a given period. In cases where the exact require-

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ments cannot be actually forecasted, or the facilities do not permit of large quantities being stored, contracts are made to call for delivery as required. This applies also to supplies of a perishable nature, such as fresh provisions.

Miscellaneous demands from the Fisheries and other branches, that cannot conveniently be referred to the dockyards, are dealt with to best advantage along similar lines.

Considerable purchases were made on behalf of the Imperial Government, and in lesser degree on behalf of the Australian Navy and Allied Governments.

As far as possible, all purchases were made in Canada, from Canadian manufacturers.

Contracts were entered into for the charter of eighteen vessels of varying dimensions, and nineteen large motor launches, for service as required. Expenditure under this head totalled \$373,139.

Altogether twenty-three ships were victualled by contract, necessitating the execution of a like number of contracts.

Contracts were maintained on both the east and west coasts for the supply of fresh provisions at short notice to all service ships requiring such, both Canadian and Imperial. Also contracts were made for the supply of staple provisions. The Imperial Government and ships of the Imperial service took advantage of these contracts to a very considerable extent. Exclusive of purchases made by Imperial ships direct, purchases under this head totalled \$262,973.

Contracts were entered into for materials for uniforms and clothing, for the making of uniforms and clothing, and for ready-made clothing of all kinds. Considerable difficulty was experienced in this connection owing to the great scarcity of raw materials and dyes, but these were overcome. Purchases under this head totalled \$211,842.

Medical supplies to the value of \$7,026 were purchased as required by ships and establishments to replenish.

Difficulty was also experienced in placing contracts for metals and procuring deliveries, owing to the unprecedented demand for the manufacture of munitions, and to the diversion of labour and facilities to this purpose. There was, however, no dislocation of operations on this account. Other naval stores were procured to best advantage, either by contract or purchase. Contracts were made for coal, to be supplied as required, not only to ships of the Canadian Service, but also to ships of the Imperial Service, and to transports. Altogether purchases under this head totalled \$1,913,766.

Practically all ordnance stores and ammunition were procured from the Imperial Government. Purchases under this head totalled \$42,852.

All stationery and printing was procured through the Government Printing and Stationery Department. Purchases under this head totalled \$46,810.

Following is a summary of the purchases made during the year:—

Provisions..	\$ 262,973
Clothing..	211,842
Medical stores..	7,026
Naval Stores, not including fuel..	832,503
Fuel..	1,081,263
Ordnance and ammunition.	42,852
Stationery and printing.	46,810
	<hr/>
	\$2,485,269

II. STOREKEEPING SECTION.

The work of the whole branch hinges largely on the activities of this section, and the activities of the section depend on the demand for supplies. Organized primarily for the purpose of keeping ships of the Naval Service supplied with stores, the branch has expanded in keeping with the growth of the department, until, in addi-

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tion to ships and establishments of the Naval Service proper, service is also rendered to nine ships of the Fishery Protection Service, a number of small vessels connected with the Fishery Patrol Service, six vessels of the Hydrographic Surveys, and to the Royal Canadian Naval Volunteer Reserve, the Radiotelegraph Service, the Life-Saving Service, and to the fish hatcheries and other fishery establishments throughout the Dominion. Necessarily the work of the dockyards in the manufacture and repair divisions has increased also in keeping with the growth of the department, and the filling of demands from this source is not the least of our duties.

During the year there were added to the Naval Establishment three small ships by purchase, two others by loan from private individuals, two by transfer from other departments of the Government, and thirty-seven vessels of sorts by charter, or forty-four in all. Of the latter, nineteen were motor launches, requiring little aside from uniforms, and fuel and oil, in the way of stores.

In addition, during the year ships of the Imperial Service, and transports, and in lesser degree ships of sister colonies and allied Governments, have taken increased advantage of our facilities to secure supplies, drawing freely as occasion demanded.

Supply depots are maintained at both the Halifax and Esquimalt dockyards. These are in charge of experienced store officers, who supervise the work and who are responsible to headquarters for the performance of the duties allotted to them. It is their duty to be prepared at all times to provide and issue supplies, of whatever nature required, to all ships and establishments under the jurisdiction of the department, and to such others as may be approved by headquarters; to make a strict and careful accounting of all such issues; and to see that all supplies purchased are in accordance with specifications and suitable.

The variety of stores handled is necessarily very wide, and includes staple provisions; uniforms and clothing of all kinds and materials; medical supplies, surgical instruments and hospital equipment; lumber of all kinds; metals of all kinds and in every state of manufacture; hardware and tools; textiles and cordage; packings and rubber goods, paints, oils, glass, leather goods, brushes, furniture and furnishings, tackle, navigating instruments; charts and other miscellaneous supplies of every nature; electrical stores; fuel; and ordnance and ammunition. In the inspection and choosing of these expert knowledge and wide experience are essential. For ships of war particularly, excellence of quality and reliability are of almost vital importance.

The nature of the service demands that large reserves must be maintained and kept readily available at all times. In times of peace ships' requirements can be forecasted very accurately, as their allowances are regulated carefully and authorized by warrant. In time of war, however, these allowances are increased automatically, and in addition, preparation must be made for the unexpected. Ordinarily and within reason these reserves are based on six months' requirements for all purposes. To the end that all demands might be met promptly, reserves for this year were materially increased, particularly at Halifax, at which point it was anticipated the bulk of the unexpected business would be done. At the commencement of the year the reserves at Halifax totalled in value \$376,000, and at Esquimalt, \$280,000. At the close of the year the reserves at Halifax totalled in value \$504,763, and at Esquimalt \$298,532.

At the commencement of the year requisitions were prepared as usual, providing as far as possible for all requirements for the ensuing year, and the maintenance of reserves. Unforeseen requirements were covered by supplementary requisitions as necessary, those of an urgent nature being purchased locally to best advantage. Receipts during the year totalled in value, at Halifax, \$639,096, and at Esquimalt, \$301,866, involving, all told, approximately 9,000 transactions.

Issue transactions during the year numbered approximately 10,000 at Halifax and 8,000 at Esquimalt, aggregating in value \$510,333, and \$283,334, respectively.

The Imperial authorities have kept in reserve at both dockyards large supplies of special stores for use of ships doing duty in North Atlantic and Pacific waters.

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These reserves are confined to stores peculiar to particular ships and not common to all. Assistance was afforded them in the handling and accounting for these. Transactions and values in this connection are not included above.

At the commencement of the year there was in stock at Halifax, 13,984 tons of coal, and at Esquimalt 9,700 tons. During the year there was received, at Halifax 6,902 tons, and at Esquimalt, 5,946 tons. Issues during the year totalled, at Halifax, 13,938 tons, and at Esquimalt 11,544 tons. As this was in large part Admiralty coal, the total value is not included in the figures given above.

In addition, very large quantities were accounted for in direct issue to ships by contractors and from colliers. In this manner 97,427 tons were handled at Halifax and on the east coast, and 26,129 tons at Esquimalt and on the west coast.

Supply depots were maintained at outlying points for the convenience of vessels doing duty along the Atlantic coast and in the gulf of St. Lawrence.

A general stocktaking was inaugurated at both dockyards in the fall of 1915 and completed at the close of the year. Stock to the value of approximately \$800,000 was brought under survey, and the result, under the circumstances, was most gratifying.

III. TRANSPORTATION.

The arrangements under which the department in conjunction with Mr. A. H. Harris, Acting Director of Overseas Transport, is responsible for the necessary work in connection with the export of materials on behalf of the Imperial Government, have been continued in force and greatly extended during the financial year 1915-16.

This service had its origin shortly after the outbreak of war, in the provision of cargoes for empty Admiralty colliers returning from this side of the Atlantic to European ports. Since then it has gradually developed into the present organization under which several thousand tons of material of all kinds are gathered every day from all parts of Canada at the ports of loading and are shipped overseas.

The sailings under this service now average more than one a day. All ships are fine modern vessels of suitable capacity for the Canadian trade, and are allocated by the Admiralty for this service as necessary.

Control of the traffic inland, by rail and otherwise, its reception and storage at the shipping ports, the allocation of cargo to the different ships, and stowage on board of the various materials so as to provide for the maximum use of the tonnage at our disposal comes under the jurisdiction of Mr. Harris and his staff, who have been lent to the Government for this purpose by the Canadian Pacific Railway Company.

The movement and control of the ships are under the direction of the department, who act for the Imperial Government, and are the medium of communication with them on all matters relating to the service.

During the season of navigation on the St. Lawrence the arrival, loading, and despatch of ships proceeded with regularity. The average time of loading being under five days for each ship.

Owing to the unusually severe winter conditions and consequent snow blockades on the railways during February and March, the work was performed under great difficulties during the winter season of navigation.

In view of the greatly increased export business and consequent congestion of shipping at St. John and Halifax, the task of finding accommodation for all vessels required the most careful consideration and constant attention from the port and railway authorities and staff of the transport service. At St. John practically no delays were experienced, but owing to the longer railway haul and less efficient equipment the congestion was more acutely felt at Halifax.

Arrangements have been made with the harbour authorities for the provision of dock accommodation at Montreal, St. John, and Halifax as necessary for the efficient handling of the vessels.

Through the courtesy of the Canadian Pacific Railway authorities, their facilities at all ports have been placed at the disposal of the service. Advantage has been taken of these to a large extent.

All disbursements, with the exception of those on account of bunker coal, on behalf of the service are made in the first instance by that company, who are afterwards reimbursed by the department on presentation of certified claims covering the expenditure incurred on account of each ship.

Contracts for the supply of bunker coal have been arranged for with Canadian firms, and many thousands of tons have been purchased for the use of the various vessels in the service.

Arrangements have been entered into, as necessary, for the docking, repair, and fitting of ships for special purposes and for the supply of such provisions, stores, and gear as are required while the ships are in Canadian ports.

In addition to the ordinary work of the service, more than forty cargoes of timber have been exported from Pacific and Atlantic Coast ports. These aggregate upwards of 125,000,000 feet b.m. in the period under review.

The following statements show the growth of the service, its extent, and the disbursements made on account of the same by the department.

OVERSEAS Tonnage Cleared, 1915-16.

Month.	Port.	Tons.	Total.	Month.	Port.	Tons.	Total.
			Tons.				Tons.
April.....	St. John, N.B.....	23,218	35,307	October....	Montreal, Que.....	54,479	70,037
	Halifax, N.S.....	12,089			Charlottetown, P.E.I.	1,385	
					Vancouver, B.C.....	14,173	
May.....	St. John, N.B.....	9,060	43,331	November..	Montreal, Que.....	90,916	103,198
	Montreal, Que.....	26,085			Vancouver, B.C.....	12,282	
	Halifax, N.S.....	5,286		December..	St. John, N.B.....	67,484	103,084
	New York, U.S.A....	2,900			Halifax, N.S.....	35,600	
June.....	Montreal, Que.....	38,859	38,859	January...	St. John, N.B.....	65,516	105,252
					Halifax, N.S.....	30,126	
July.....	Montreal, Que.....	32,272	41,187		Vancouver, B.C....	9,610	131,577
	Quebec, Que.....	3,951		February...	St. John, N.B.....	79,808	
	Qaspe, Que.....	362			Halifax, N.S.....	51,769	
	Vancouver, B.C.....	4,602		March.....	St. John, N.B.....	109,225	173,538
August.....	Montreal, Que.....	38,312	58,544		Halifax, N.S.....	63,692	
	St. John, N.S.....	7,293			Esquimalt, B.C.....	621	
	Halifax, N.S.....	6,636		Total....			973,805
	Vancouver, B.C.....	6,303					
September.	Montreal, Que.....	49,704	69,891				
	St. John, N.B.....	6,587					
	Vancouver, B.C.....	13,600					

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STATEMENT of Disbursements on Account of Overseas Transport Service, April 1, 1915, to March 31, 1916.

Bunker Coal.	Stevedoring, supplies and ships expenses, etc.	Repairs, fittings, alterations, etc.	Total.
\$760,993.....	\$674,654	\$185,200	\$1,620,847

GENERAL.

It is desired to express gratification at the manner in which the staff of the Stores Branch at Ottawa and at the dockyards have performed their duties during the period under review. All have shown by their zealous and painstaking efforts and the constant interest they have taken in the work, their desire to build up an efficient service. At the dockyards, in particular, the work has been strenuous. The routine work of the department has proceeded without friction or delay. Constant unforeseen requirements have arisen and have been dealt with in a manner which reflects great credit on the Naval Store officers and their staffs.

At headquarters the staff, though short of members lent for service temporarily to the dockyards to assist in coping with the greatly increased work there, have been able to deal effectively with all questions arising and have spared no efforts to keep pace with the increased work and responsibility.

The Naval Store officers at Esquimalt and Halifax, and the heads of the purchasing and storekeeping sections at headquarters deserve great credit for their work during the year.

As regards the transportation section of our work, for obvious reasons no details have been entered into. The harmonious relations which have existed between the acting director overseas transport and his staff and the department, and the ready co-operation in all matters relating to the transport service have made the duties of great interest and pleasure. Too much cannot be said of the remarkable work which has been accomplished by Mr. Harris and his staff.

I have the honour to remain, sir,

Your obedient servant,

J. A. WILSON,

Director of Stores.

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FISHERIES PROTECTION SERVICE.

DEPARTMENT OF THE NAVAL SERVICE,

OTTAWA, April 1, 1916.

The Deputy Minister,
Department of the Naval Service,
Ottawa.

SIR,—I have the honour to report as follows regarding the Fisheries Protection Service for the fiscal year ending March 31, 1916, as to the number of vessels and men employed, the stations of the different vessels, brief descriptions of the same, and the names of the commanding officers. I have also included extracts from the reports of the various commanding officers to give some idea of the work carried out during the season.

I may add that although it was found necessary to utilize these vessels to a great extent for examination service, mine-sweeping, and other duties in connection with defence, both on the East and West Coasts; at the same time instructions were given to commanding officers to keep a strict lookout for any infraction of the fisheries laws, while primarily occupied with other duties.

The Fisheries Protection Service still consists of ten vessels, although one of these, the *Canada* has been commissioned under the White Ensign for considerably over a year, and will probably continue in the Naval Service until the cessation of hostilities.

NAMES OF VESSELS AND THEIR COMMANDING OFFICERS.

Canada.—Lieut. Commander C. J. Stuart, R.N.R.

Curlew.—W. J. Milne.

Constance.—J. E. Morris.

Gulnare.—Clement Barkhouse.

Petrel.—C. O. McDonald.

Vigilant.—P. C. Robinson.

Galiano.—Lieut. R. M. Pope, R.N.R.

Malaspina.—Holmes Newcomb.

Restless.—Charles Moore.

Newington.—(Chartered)—H. R. Bilton.

C.G.S. "CANADA."

Is a twin-screw steel ship, length 206 feet, beam 25 feet, draught 11 feet 2 inches, registered tonnage 411 tons, speed 16 knots. When on fisheries protection duty she is armed with two 12-pdr. Q.F. and two 3-pdr. Hotchkiss guns. The vessel is electrically lighted throughout, and is fitted with a powerful searchlight. Her complement is sixty officers and men, all told, and she was built by Vickers, Sons & Maxim, Limited, England, in 1904. She is commanded by Lieut.-Commander Charles J. Stuart, R.N.R.

The *Canada* was commissioned under the White Ensign, as above stated, shortly after the outbreak of hostilities, and has not since been engaged in fisheries protection work.

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C.G.S. "CURLEW."

Is a composite, single-screw vessel, length 116 feet 3 inches, beam 19 feet 8 inches, draught 11 feet, speed 10½ knots, and registered tonnage 157.85 tons. Her complement is twenty-two officers and men, all told, and she is commanded by Capt. W. J. Milne.

On April 1, 1915, the ship was at H.M.C. dockyard, Halifax, undergoing repairs, on completion of which she returned to the bay of Fundy station. Here after a few days on naval service she patrolled the fishing grounds off St. John, Grand Manan, Brier island, and Seal island, searching for illegal fishing, also visiting the life-saving stations at Brier and Little Wood islands. On the 31st May a dispute among the salmon fishermen at Gulliver's cove, Nova Scotia, was settled by the commanding officer, and on the 2nd June the United States fishing vessel *Mary A. Osier* was stopped at Black's Harbour for a breach of the Customs laws and turned over to the Customs authorities, who imposed a fine upon the owners; the vessel was later transferred to the British flag.

The early part of June was spent in watching American steam trawlers to prevent fishing in Canadian waters or other breach of the law. During the latter part of the month assistance was given to the overseer of fisheries in obtaining evidence to convict two Canadian fishing boats of engaging in the use of purse seines in the vicinity of Moore's Bank, Brier island, the owners and crews of these vessels being heavily fined.

Part of July, ship was engaged in carrying out orders from headquarters in matters connected with defence, and from August to the end of December she carried out fisheries protection duties except for short periods now and then when called upon for other services. During August the United States smacks fishing for lobsters outside territorial waters near Seal island were carefully watched to prevent fishing within the three-mile limit. In November, Little Wood island and Brier Island life-saving stations were again visited, and on the 14th December the fishing schooner *Albert J. Lutz*, blown ashore at Yarmouth in a gale, was taken off and towed to safety.

Seal Island life-saving station was visited on the 17th December, *Curlew* afterwards leaving for Halifax, where she arrived on the 23rd, and was docked for minor repairs.

She proceeded on naval duties again about the 23rd January, and continued on them until the end of the fiscal year. During the winter she was able to render assistance to the capsized schooner *Pricillia*, and the three-masted schooner *Moama*, which was found anchored in dangerous proximity to the rocks off the Sugar Loaf.

During the year, various foreign vessels, yachts, lobster smacks, and sardine boats in the harbours and territorial waters were boarded, their crew lists and other documents examined, and orders given them to report at the customs house; the fisheries officers were assisted in their duties, and fishing boats searched for illegal gear.

The commanding officer reports very few pollock schooled about Grand Manan during the past season, but that an unusual number remained all summer schooling in the tide rips at Brier island. Early in the season a considerable number of pollock were caught with purse seines outside the territorial waters about Brier island.

C.G.S. "CONSTANCE."

Is a single-screw composite steamer, whose length is 115 feet 6 inches, beam 19 feet 6 inches, draught 11 feet 6 inches, and registered tonnage 125 tons. Her complement is twenty-three officers and men, all told, and she is commanded by Capt. J. E. Morris.

Constance was required for examination service and other defence purposes throughout the spring and summer of 1915; on the 27th October she went into dockyard hands and remained there until the 19th December, when she took a short cruise

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in the straits of Northumberland and along the west coast of Cape Breton, before returning to naval duty. On the 28th February she again returned to Halifax for annual refit.

During the year *Constance* steamed 8,874 miles.

C.G.S. "PETREL."

Is a steel, single-screw ship, length 116 feet, beam 22 feet, draught 9 feet, speed 11 knots, and registered tonnage 191 tons. Her complement is twenty-four officers and men, all told. The vessel was commanded by Capt. Clement Barkhouse until the 15th March, after which date Capt. C. O. McDonald took charge of the vessel.

This vessel re-commissioned at Shelburne, N.S., on the 1st April, 1915, and up to the 26th May was on defence duty; she was then placed in dockyard hands for annual refit, on completion of which, about the 18th June, she proceeded to Canso and Cheticamp where the life-saving stations were inspected.

Throughout the remainder of the year she was required for naval purposes, with the exception of a few days spent in inspecting life-saving stations, having boilers cleaned, etc. On the 14th September an unsuccessful effort was made to refloat the schooner *Vera B. Roberts*, stranded on the east end of the island (Pictou), and on 2nd February assistance was rendered to a disabled motor-boat which was found drifting seaward; this boat was towed to Head harbour. The American tern schooner *Andrew Nebbinger*, which grounded at Beaver harbour, was also taken off and towed to safe anchorage.

C.G.S. "GULNARE."

Is a steel, single-screw vessel whose length is 137 feet, beam 20 feet 5 inches, draught 12 feet, registered tonnage 262 tons. Her complement is twenty-five officers and men, all told. This vessel was commanded by Capt. C. T. Knowlton up to 13th October, 1915, when he resigned and the ship was placed under the command of Mr. Smith, first officer. On the 8th January, 1916, Capt. P. C. Robinson was placed in command until relieved by Capt. Clement Barkhouse, appointed commanding officer from the 15th March, 1916.

Throughout the year the *Gulnare* was required for naval duties and was not available for fisheries protection service. She steamed 6,894 miles, and was at sea 3,901 hours.

C.G.S. "VIGILANT."

Is a twin-screw steel ship, whose length is 177 feet, beam 22 feet, draught 9 feet 6 inches, registered tonnage 242 tons, and speed 16 knots. She is electrically lighted throughout, and fitted with a powerful searchlight. Her complement is thirty officers and men, all told, and she is commanded by Capt. P. C. Robinson.

On the 1st April, 1915, ship was put into commission at Port Dover, the necessary repairs have been carried out during the winter months, and she at once proceeded to the west end of lake Erie to patrol the fishing grounds. In May the vessel visited the life-saving station at Point Pelee, where the ship's crew assisted the life-saving crew to build a new run-way for launching the life-boat. The latter part of June and the early part of July was spent at Port Colborne, where the electric welding of the boilers was completed. *Vigilant* then proceeded to lake Ontario, where she cruised until 21st July, when she returned to lake Erie. On the 23rd July the Canadian fishing tug *Anko*, adrift in lake Erie, was picked up and towed to Port Dover.

During August and September patrol work was carried out continuously, as American fishermen were actively engaged in illegal fishing in the vicinity of Long Point. The work of patrolling the boundary line was continued until the 15th November, when the vessel proceeded to Port Colborne to meet the Director of the Naval

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Service and the Consulting Naval Engineer, the latter examining the engines of the vessel. She then proceeded on patrol duty again until the 7th December, when, ice having begun to form, orders were sent to lay up for the winter, and the ship went into winter quarters at Port Dover on the 17th December.

During the season the usual amount of poaching was attempted. In past years poachers always used buoys on their nets, but this season they adopted the plan of setting nets without the least mark on them, so that they could not be seen and almost all of the nets seized were taken with grapple. The owners of the nets could find them by running from a mark buoy south of line. In all the ship steamed 7,351 miles and seized 1,531 nets, the greatest number of which were sold at auction and the proceeds forwarded to the department.

C.G.S. "MALASPINA."

Is a steel single-screw vessel, whose length is 160 feet, beam 26½ feet, draught 12½ feet, speed 14½ knots, and displacement 700 tons. She is electrically lighted throughout and fitted with a powerful searchlight. Her complement is thirty-three officers and men, all told, and she was built by the Dublin Dockyard Company, Dublin, Ireland, in 1913. She is commanded by Capt. Holmes Newcomb.

In April this vessel was on examination and other services, but in May proceeded to patrol the northern waters on fisheries protection service, returning to Esquimalt on the 6th June; on the 9th June she was inspected by the Director of the Naval Service, afterwards being placed in dry dock for painting and overhaul. From the 6th July to the 22nd September the vessel was on fisheries protection service with the exception of two days when her services were required at Esquimalt. During part of this time the Sea-lion Commission were on board, making investigations. From the 1st October to the 13th December she was cruising in northern waters and then returned to Esquimalt for other service, which continued until the 6th January, 1916. From the 7th January to the 27th February, ship was in the dockyard undergoing repairs, after which she again went on naval service. From the 7th March to the end of the fiscal year *Malaspina* cruised along the coast on combined naval and fisheries protection duties.

C.G.S. "GALIANO."

Is a steel, single-screw vessel, length 160 feet, beam 26½ feet, draught 12½ feet, speed 14½ knots, and displacement 700 tons. She is electrically lighted throughout and fitted with a powerful searchlight. Her complement is thirty-three officers and men, all told, and she was built at Dublin, Ireland, by the Dublin Dockyard Co., in 1913. She is commanded by Lieut. R. M. Pope, R.N.R.

This vessel was in commission on the 1st April, 1915, upon which date she left Union bay and proceeded to Esquimalt. On the 8th April she proceeded on naval duties, and while in the vicinity of Massett also interviewed the fishery overseer, Mr. Harrison. The vessel then returned to Esquimalt via the west coast, arriving on the 17th April. From the 23rd to the 26th April she was utilized in connection with mine-sweeping in company with C.G.S. *Malaspina*. On the 29th April she proceeded north on fisheries protection duty. A schooner sighted back of Discovery Island was found to be the *Liefe* of Seattle, anchored for shelter, but as the weather had then cleared she was ordered to sea. *Galiano* proceeded on patrol until the 2nd May, when orders were received to return to Esquimalt, when she was utilized for other service until the 31st. On the 1st June ship proceeded to Vancouver to meet the Director of Naval Service who remained on board for some days, making a tour of inspection of the life-saving stations; on the 12th June he was landed at Vancouver and ship returned to Esquimalt, proceeding on regular fisheries patrol work on the 19th, and continuing in that service until the 2nd August, when she returned to Esquimalt for other service.

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On the 17th August she again proceeded on fisheries duty along the coast of Vancouver island, and on this cruise the American fishing boat *Solano of Seattle* was seized for fishing within territorial limits and handed over to the Chief Inspector of Fisheries at New Westminster. On the 30th August, ship returned to Esquimalt, and on 8th September was placed in drydock for repairs, after which she undertook naval duties until 7th October, when fisheries work was again taken up, and the fleet of boats operating around Beecher bay was visited. About the 20th October *Galiano* proceeded to Alert bay, and cruised on the west coast of Vancouver island until the 30th; weather conditions on this cruise were reported very bad. She then returned to Esquimalt and acted under the orders of the Naval Service officials until 29th February, on which date she went into drydock for refit. Between the 15th and 28th March she again acted under naval orders, afterwards preparing to take up the regular work of the fisheries protection service for the coming year.

During the year sixty-one Canadian and four American vessels were spoken, and thirty-seven places were visited; 8,200 miles were steamed on fisheries work and 2,882 on Naval Service.

C.G.S. "RESTLESS."

Length 71 feet, beam 17 feet, draught 7 feet, is commanded by Capt. Charles Moore.

This vessel has been employed continuously on naval duties at Esquimalt, since the outbreak of war. On the 12th May, 1915, she underwent her annual inspection and refit, returning to duty on the 22nd May. She was again docked on the 22nd November for refit of machinery and boiler, returning to duty on the 3rd December. During the year *Restless* steamed 1,522 knots and was under way 627 hours.

C.G.S. "NEWINGTON."

Is a chartered vessel and has been throughout the past year employed on naval duties, and therefore unavailable for fisheries protection. She is commanded by H. R. Bilton.

I have the honour to be, sir,

Your obedient servant,

C. E. KINGSMILL, *Vice Admiral,*
Director of the Naval Service.

SURVEY OF TIDES AND CURRENTS.

DEPARTMENT OF THE NAVAL SERVICE,

OTTAWA, March 31, 1916.

The Deputy Minister,
Department of the Naval Service,
Ottawa.

SIR,—I have the honour to submit the following report regarding the Survey of Tides and Currents during the twelve months ending March 31, 1916.

Considerable progress has been made in directions which will contribute to the greater accuracy of the tide tables in future years, in addition to the regular work of their preparation and publication, and the maintenance of the tidal stations themselves. Further information on the tides and currents in eastern Canada has now been added to the tide tables; and in several cases the methods of calculation have been improved by revision and the incorporation of additional data to extend the basis from which they are made. The region of Northumberland strait, which has always been a complex one, has now been dealt with comprehensively; which will benefit the harbours there, including the new car ferry terminals, to which special consideration has been given. The currents in Bras d'Or and Grand Narrows were investigated, and their movements brought successfully into relation with the tide tables. Some observations were obtained in the gut of Canso, which at least enable the extremely complex nature of its currents to be definitely understood, and their behaviour to be explained. The tidal observations at the head of the Saguenay have made it possible to give satisfactory tidal data for the whole region, which will be helpful to the growing industries there.

In British Columbia, the time of slack water in additional navigable passes has been reduced to law, and further observations obtained to improve the accuracy of the tables calculated for the principal passes. This will be of benefit to the lumber and coal industries, as well as to general navigation. The data from which the tide tables for Nelson in Hudson bay are calculated, have now been revised throughout, and improved by the incorporation of further observations. Tidal information from new localities in James bay has been obtained, which will enable this survey to furnish fairly good data for any railway terminals in that bay, until more complete observations can be secured.

Further data for mean sea-level as a basis for levelling operations throughout Canada, have been furnished to other departments; especially for work in British Columbia. For the extended levels throughout Prince Edward island which are in progress, the true value of mean sea level at Charlottetown has been supplied. This is based on five complete years of tidal observations; and no such accurate value could be obtained at short notice when important levelling operations are undertaken.

PRINCIPAL TIDAL STATIONS.

There are six principal stations maintained in eastern Canada, from Quebec to the entrances of the gulf of St. Lawrence, and in the bay of Fundy. All these require to be constructed with tide pipes protected by a surrounding air chamber in which heating is supplied, to prevent freezing in winter, and thus to secure a continuous record. In British Columbia there are five principal tidal stations which are main-

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maintained in continuous operation throughout the year. Various methods are employed to obtain correct time at these stations; at some of them the time being obtained direct from the sun by a meridian instrument; at others a chronometer is used, or a high-grade watch where the time can be checked by telegraph or by wireless signals. The other essential to give value to the observations is a correct datum, which is maintained from year to year by special levelling at the station, and by comparisons made daily by the observer.

The harmonic analysis of these observations made during the past year has been chiefly for the benefit of eastern Canada; as more of this was done for the Pacific coast the year previously. Two complete years of tidal record from Quebec were submitted to analysis, two years from Father Point, two from St. Paul island, and two from Charlottetown; as well as one additional year from Victoria, B.C. This work will improve still further the accuracy of the tide tables for these ports.

FURTHER TIDAL OBSERVATIONS OBTAINED.

The tidal observations during last season were carried out for definite purposes; as the tidal stations were either established for reference, or to obtain data for developments in new regions. They may best be summarized under the various regions where they were taken.

Northumberland Strait.—There were two objects in view here; to complete the eastern end of the strait, along the coast of Cape Breton island, by obtaining observations at Port Hood and Cheticamp; and to obtain data for the car ferry to Prince Edward island, now under construction between cape Tormentine and Carleton head. As a reference station for comparison, a tide gauge was established at Pictou; and the permanent stations at St. Paul island and Charlottetown afforded simultaneous observations for comparative purposes.

This work was started early, at the end of May, to cover the period of the solstice, as the region is known to be under the dominant influence of declination. The engineers in charge of the car ferry works, Mr. F. B. Fripp at cape Tormentine, and Mr. H. M. Downing at Carleton head, were supplied with registering tide gauges, and they kindly undertook to give the observations their supervision, to see that the time was accurately kept, and the datum level for the height of the tide correctly maintained.

The outcome of this work is explained further on, in its general relation to Northumberland strait as a whole; and the grouping of its harbours for tidal accuracy.

Cape Breton; northeast coast.—On this coast the tide gauges were erected at St. Ann harbour, which is developing as a shipping port; and at Sydney, as the only observations so far obtained there were for one month in 1901. The time of the tide at these harbours is referred to St. Paul island; and the difference in time as found for Sydney in 1901 by a special method for dealing with so short a period of observation, was only modified three minutes by the result of the new observations. These further observations will have other uses, however, in connection with tide levels, etc.

By comparison of the new results with the former observations of 1901 at Neil harbour, values for Ingonish were also obtained, based on difference of establishment, which will be quite satisfactory.

Saguenay region.—The railway from Chicoutimi to Bagotville in Ha Ha bay at the head of the Saguenay, and the shipping facilities which are under construction at Bagotville, are indications of the growing importance of this region.

The only observations previously available at Chicoutimi were taken in 1897 for two months; but they were sufficient to show the remarkable similarity of the tide there to Quebec. The extended observations of last season will now give reliable differences with Quebec for high and low water; and will make the tide tables, which

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are computed locally, as accurate as our published tables. The tide scale for height in the observations was set accurately in correspondence with the low-water datum established by the Public Works Department. The rise of the tide as given on the chart, proved to be erroneous; probably owing to misunderstanding regarding the change during the freshet period in the river. The actual rise of the tide has now been ascertained, with distinction from the freshet levels.

At Bagotville, which is at the true head of the Saguenay inlet, the tide was found to be in correspondence with Father Point on the Lower St. Lawrence. This will enable the tide throughout the whole of the Saguenay to be known; as the new observations show that the difference in the time of the tide from Tadoussac to Bagotville is only twelve minutes. So small a difference can readily be allowed for, in the navigation of the Saguenay, and by the industries along it. The new information obtained will thus apply to the whole region; and the tide is an important matter, as the rise is from 17 to 18 feet at spring tides.

Lower St. Lawrence.—Observations were obtained last season by co-operation with the Hydrographic Survey, at Grand Mechins and Godbout; this latter place being practically the same as Point des Monts, the true dividing point between the gulf of St. Lawrence and the estuary. The establishments, which indicate the time of the tide, were seriously out until recently, for the region between Father Point and Anticosti; but sufficient observations have been secured in recent years to enable a general revision to be made.

Tide levels at the summer stations.—Wherever a low-water datum existed, it was made use of for the new observations. At cape Tormentine and Carleton head, the established datums were utilized for reference; and a low-water datum at Pictou, which was determined by this survey in 1902, has been used for all observations since obtained. At Sydney, the masonry building on which the Tidal Survey bench-mark of 1901 was placed, was demolished; but it was found possible to recover and maintain the same levels as in the former observations. At Port Hood, Cheticamp, and St. Ann harbour, new bench-marks were established to which the tide levels were referred. At Chicoutimi and Bagotville, the tide scales for the observations were set accurately in correspondence with the original low-water datums established by the Public Works Department and by the Chicoutimi and St. Alphonse Railway, which are defined by existing bench-marks.

By thus fixing the tide levels permanently with reference to bench-marks, the observations are much enhanced in value; as they become available in harbour improvements or dredging for which the levels of high and low water at extreme tides are of importance. On the other hand, if this trouble is not taken, the tide levels are quite lost after a few years. Their value is evident, as the levels must be known in advance, when any wharf repairs of consequence or other harbour improvements are undertaken.

Pacific coast.—In 1914, when the moon still maintained as great a range in declination as it attains during the 19-year cycle, a tide gauge was established at Caulfeilds, the pilot station near point Atkinson, in the strait of Georgia. The tide of the open strait is thus being obtained, which is practically identical with the original station at Sand Heads; and the observations will be maintained for two complete years to supplement the Sand Heads series. A truly corresponding datum level for reference has also been determined.

These observations at Caulfeilds were also utilized for comparison with the time of slack water in the passes which were investigated in 1914 and 1915. It is known that the time of the tide at Caulfeilds does not differ more than five minutes with Sand Heads; and a comparison with the simultaneous tidal record there, is more steadily accurate than with the predicted times at Sand Heads. The Caulfeilds station is thus serving a double purpose.

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Observations were obtained at Ganges harbour last season; an important shipping point for produce in the Gulf islands. The original Admiralty low-water datum was utilized for these observations, and accurate time was used.

Two tide gauges were lent to the Hydrographic Survey for use on this coast; and in this way observations have been obtained at Shingle bay at the mouth of Skidgate inlet to compare the open tide with the range within the inlet at Queen Charlotte city. This comparison was continued at the two places simultaneously for over two months. Further tidal record was also obtained at Pacofi in the Queen Charlotte islands. The object of these observations is primarily for the reduction of soundings in the hydrographic work, and the registering gauges save much trouble and expense in obtaining this information; while at the same time the record obtained is of value to this survey.

The observations at Nelson in the seasons of 1911, 1912, and 1913, consisted of readings on a staff or fixed scale, taken by the Hydrographic Survey, which were afterwards plotted as tide curves. The various standards of time used were local, eastern standard and central standard, this last being the correct standard time for Nelson. By careful reduction, by which the observations were brought to the same time standard and also to a uniform datum, good results were obtained.

In 1913, two registering tide gauges were supplied to the Railways and Canals Department, there being thus a duplicate instrument in case of accident; and Mr. D. W. McLachlan the engineer in charge at Nelson, kindly undertook the supervision of the observations. There was much difficulty in obtaining correct time, however; so that when the observations of 1914 were reduced, it was found that they could only be utilized for the difference of time between high and low water, which is one of the essential factors that the observations afford. Now that the wireless station is established, the difficulty in obtaining correct time has been overcome. The observations of 1915, in charge of Mr. A. Sutherland, the wireless operator, have thus been entirely satisfactory, except for interruptions occasioned by carelessness during construction. It has always been found that during construction no respect is paid to a tide gauge; and filling will be thrown around its column, choking it up, or a derrick arm will strike it and destroy it; although the whole design of the works is based on the data for tide levels which a tide gauge affords.

In James bay, further observations have been obtained by co-operation with the Hydrographic Survey and the Timiskaming and Northern Ontario Railway, to whom tide gauges were supplied. The observations thus obtained were taken at Strutton island off the mouth of Rupert bay; during two months; and at Moose river, both in the estuary and at Ship sands off its mouth. It is in these vicinities that any railway to James bay is likely to have its terminus.

INVESTIGATION OF THE CURRENTS.

Pacific coast.—Of the four passages between the Gulf Islands, Active pass is the most important, as it lies on the main route between Vancouver and Victoria. Next to this is Porlier pass, with a heavy freight traffic; and for these two, complete tables of slack water are calculated and published in the Tide Tables. These two are now utilized as standard passes to which others in this region are referred. The mariner thus finds the time of slack water in other passes by applying a difference of time to the slack-water tables, instead of taking a difference with the time of the tide. This is quite as convenient, and the result is more closely accurate, for the reasons explained in the Tide Tables.

Observations begun in the previous season in Dodd narrows, were continued throughout the winter until April, 1915. The observer was then moved to Gabriola pass, where observations were obtained for six months, from May to October. These passes, though accommodating a large local traffic, have uninhabited shores; and it was

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necessary to erect a temporary house for the observer and his cook, and to provide a complete outfit and supplies. For comparison with these passes, simultaneous observations were continued in Porlier pass; and to make double use of these observations, the tidal stations at Caulfeilds was maintained, which gives a tidal record for the strait of Georgia; as the comparison with this tidal record affords an extended basis from which to calculate slack water in Porlier pass itself.

From these observations, and the resulting comparisons for extended periods, differences of time for high-water and low-water slack were obtained for Dodd narrows and Gabriola pass, which enable the time of slack water to be accurately known in them. This is the information chiefly desired, as transportation is largely carried on by towing, which must be timed to go through such passes at slack water.

Another important region for which observations have been obtained, is Seymour inlet; which runs into the mainland opposite the northern end of Vancouver island. The object in view is to obtain the time of slack water in the narrow opening that leads into Seymour island itself, which is 35 miles long; together with Belize inlet, Frederick, Nugent, Mereworth, and Alison sounds, which open off it. The total area of these inlets and sounds is so large that the rise of the tide within them is only 6 to 8 feet; while in the open the rise is 14 feet on the average. Such a difference of level causes the tide to pour through in a torrent, as it rises and falls. The region around this group of inlets and sounds is an important lumbering area; but the entrance is uninhabited, and there is no regular means of communication. The importance of knowing the time of slack water is very evident, as any attempt to tow lumber out at any other stage of the tide necessarily results in wreckage.

The difficulty of installing an observer in a suitable spot was overcome; and correct time was obtained with a chronometer. Observations of the time of slack water, which is brief and definite, were secured for six and one-half months in 1915. To obtain the time of high and low water for comparison, a tide gauge was erected at Wadhams in Rivers inlet, only 25 miles distant. It was not at all certain, however, that the time of slack water would have any constant relation to the local tide; and considerable investigation was required before a satisfactory result could be obtained from the observations.

Great Bras d'Or and Grand Narrows.—The traffic through these narrows is partly local and partly on the through line from Halifax to Sydney; as many steamers prefer the inside route by way of the Bras d'Or lakes.

These lakes are connected with the ocean by the Great and Little Bras d'Or which communicate with the first expanse; and this again communicates through Grand Narrows with a second and larger expanse. The rise of the tide in the open is 3 to 5 feet, but the lakes have not time to fill up in the tidal period, and their variation in level is only about 6 inches.

The time of slack water, at the turn of the current, was observed at the entrance to the Great Bras d'Or during daylight for three months in 1915; and it was obtained at Grand Narrows by means of a registering apparatus, day and night, for five months. This apparatus was especially designed, and worked electrically. At both localities, arrangements were made to obtain accurate time for the observations.

The main object in view is to obtain from these observations a time difference between the turn of the current and high or low water at one of the tidal stations for which Tide Tables are published. The chief difficulty is to find such a difference which is reasonably constant; so that the mariner can know which way the current is running, by simply applying the difference to the time of the tide in the Tide Tables. If the difference is not constant, the result would be misleading.

As the rise and fall in these lakes is so slight, no relation is obtainable with local high water. Also, as the level is so nearly constant, the turn of the current coincides approximately with half-tide in the open. Preliminary trials showed the variation in

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the difference between current and tide to be about $1\frac{1}{4}$ hour early or late, in an irregular way. This shows the amount of error that may possibly result from the use of a constant difference; which it is the object of the investigation to reduce.

The first series of trials was made for the mouth of the Great Bras d'Or, which was likely to be less complex than Grand Narrows. Each trial comparison between current and tide was based on two or three weeks of observation. The leading trials made and the general procedure were as follows:—

The difference between high and low water at St. Paul island and the time of slack water, was not very satisfactory; and the difference with Pictou was even more variable, which pointed to an earlier tide as being better than a later one. Also, it is now known that in Northumberland strait, the current accords best with the tide in the two opposite directions across the gulf. Combining these ideas, a trial was made with the previous high water at Halifax for the one slack, and the previous low water at Father Point for the other slack. This gave an improvement, and the relation with Father Point was remarkably constant, the greatest variation being only thirty-three minutes early or late. The difference itself was large and unwieldy, however, being about $10\frac{1}{2}$ hours, yet showing such constancy. The outstanding variation is largely due to a strong alternation in the successive differences, when the moon is in high declination.

Further trials were therefore made with the following low and high water at St. Paul island instead of the previous ones. As this brought the opposite tides into the comparison, it reduced the troublesome alternation to less than one-fourth, and made the general variation as low as in the result obtained from the tides in the opposite directions, as above indicated. As it had also the advantage of being simpler in its application, it was accepted as the best relation obtainable for slack water.

With the help of these indications, a series of comparisons was then made with slack water at Grand Narrows, in a similar way. Comparisons with St. Paul island, Halifax, and Father Point showed a variation of over one hour, early or late, with little to choose between them. Another reasonable supposition was that the mid-time between high and low water ought better to agree with the time of slack; but the result showed no improvement as regards variation. Also, as slack at Grand Narrows is later than at the mouth of Bras d'Or, this seemed to indicate a comparison with a place where the tide itself was later. On making trial with Pictou and Charlottetown accordingly, this latter proved the best reference station that could be found; although the variation still amounted to nearly an hour, early or late, at the extreme which occurs occasionally.

Instead of taking the mid-time of the tide for comparison, the reverse method was then tried for Grand Narrows; namely, a comparison with the mid-time between slacks, representing the time of maximum velocity of the current. This method had proved eminently successful in Northumberland strait. Trials with Pictou and St. Paul island on the basis showed that the variation with the tide was only thirty-five to forty minutes early and late; thus reducing the variation to less than two-thirds of its amount in the best result obtainable in the comparison with the time of slack water.

When this method was tried for the mouth of Bras d'Or, it also showed a marked improvement; the best results being given by the relation with the previous high water at Halifax and the previous low water at St. Paul island. The variation was thus reduced to little over thirty minutes, early or late.

This method should be the most serviceable to the mariner, as it will enable him to find readily the time at which the current is strongest in one direction or the other, and thus to judge which way he will find it running at any given time. Any error in the exact time of maximum strength is also of comparatively little consequence for his purpose, whereas if the time of slack water were out, because of its variation, he might find the current already running in the opposite direction to what he expected.

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The final outcome of these investigations was to obtain differences of time with the Tide Tables which give the time of the "middle of flood" and the "middle of ebb" in these passages. For the Great Bras d'Or the differences apply to high water at Halifax and low water at St. Paul island; and for Grand Narrows they apply to high water at St. Paul island and low water at Pictou. The results in figures will be given in the next Tide Tables published. This middle moment in the run of the tidal streams will enable it to be known whether the flood or the ebb is running, which is the matter of chief practical importance.

The gut of Canso.—This strait connects two regions in which the tide is of two distinct types, although the range is nearly the same; being 4 and $4\frac{1}{2}$ feet at its two ends at spring tides. At the northern end, diurnal inequality is highly developed, and one tide in the day may be reduced to a level stand for ten or twelve hours. At the southern end, the tide is of the ordinary Atlantic type, and the inequality is scarcely apparent. Also, as the time of high water is not simultaneous at the two ends of the gut, the tidal streams are necessarily complex in their time relations: while in strength they often attain $3\frac{1}{2}$ knots. This general explanation has been given in the Tide Tables since 1906.

Observations of the turn of the current were obtained for nearly three months in 1915, by the captain of the car ferry *Scotia*, assisted by his first officer. These included notes every two or three hours during the night, so that the observations were fairly continuous. A digest of these observations shows that the proximate influence of tide levels may be ignored, and the behaviour of the current brought into direct relation with the declination of the moon, which is the primary cause of the diurnal inequality in the tide.

A current which is under the influence of declination, should have an equal run in the two directions when the moon is on the equator. But in this case, it was found that the runs never became equal; and this led to the discovery of a dominant flow southward, represented by an average of $2\frac{1}{2}$ hours longer flow in that direction during the course of the tidal period, or half lunar day. Consequently, when the moon is on the equator, and the flow is as nearly equal in the two directions as it becomes, the flood runs for 4 hours 55 minutes northward, and the ebb for 7 hours 30 minutes southward, on the average during the tidal period.

It was also found that at the extreme of the moon's position, when it is at its maximum declination north or south of the equator, the current turns only once in the day instead of twice, as tidal streams usually do. The two runs are also made unequal, as before, by the dominant flow southward; and the actual periods become ten hours northward and fifteen hours southward, as an approximate average.

The period in which these changes take place, is the declination-month of $27\frac{1}{4}$ days, in which the moon crosses the equator twice, going north and south. When the moon is near the equator, the behaviour resembles an ordinary tidal stream, turning twice a day, but in the course of the next six or eight days, two of the runs in the day increase in length till the other two are reduced to a period of weak current and then disappear altogether, leaving only one run in each direction by the time the moon reaches its maximum declination north or south. From then on, the transformation is reversed for six or eight days, until the moon again crosses the equator. Throughout these changes, there is an over-balance in favour of the southward direction as explained.

Under these conditions, it is only possible for the current to have a definite relation to the time of the tide when the moon is near the equator; that is, during two groups of about three days each which occur twice in the declination-month. It is not necessary that the relation should be with the tide in the gut itself; as the observations so far obtained appear to show that the best relations to the tide are with high water in Northumberland strait and low water in the Atlantic; or possibly with the tide

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at St. Paul island, which is exactly opposite the gut at the other end of Cape Breton island; and as the tide is there intermediate in character between the two ends of the gut, it may thus average the inequalities.

The greater flow southward in the gut of Canso, appears to correspond with the constant outward flow from the gulf of St. Lawrence towards the Atlantic, which takes place around the north end of Cape Breton island.

The effect of the wind upon the current is chiefly due to the raising of the water level during north and northwest gales, in the angle of the gulf of St. Lawrence at the northern end of the gut. The flow in the southward direction is then increased, or prolonged to some extent. Winds from the opposite quarter have less effect. The disturbance is also more apparent if a storm occurs while the current is in a transition state, when there would be normally long periods of slack. Far too much has been attributed to wind influence, however; as the main features in the behaviour of the current have astronomical causes; and the strongest winds in the summer season are unable to obliterate these features.

IMPROVED METHOD OF CALCULATION.

After the tide tables for the six principal harbours on each coast have been calculated by means of the tidal constants which result from harmonic analysis, there are next eight tables for secondary localities or for the time of slack water and the turn of tidal streams, that require to be computed; besides the tide tables for Nelson in Hudson bay, and three tables required for the summer season. These computations are made by means of differences with the ports of reference, which usually vary in a more or less complex manner. The values used are improved upon, when further observations are obtained as a basis; or it may even be possible to modify the system of computation itself if any improved method can be discovered.

Seymour Narrows.—A very large traffic passes through these narrows; not only the Canadian coasting steamers, but also the United States trade to Alaska, although the shores are uninhabited. Since the first observations of slack water were obtained by the United States Coast Survey in 1897, two additional seasons of observation have been secured by this survey, making a total of twenty-two months in all.

The calculation of the time of slack water is based on three principles already arrived at: (1) the tide on these coasts is of the declination type, and the variations to be allowed for, are in accord with the declination of the moon, and the declination of the sun during the year; (2) the time of slack water is quite out of relation with the local tide, but accords with the tide of the open ocean, outside Vancouver island, the best reference station for this tide is Port Simpson; (3) the best relation with Port Simpson is with the previous tide for high-water slack, and with the following tide for low-water slack.

For high-water slack, the difference with the time of high-water is fairly constant, although evidently subject to an annual variation with the declination of the sun. The problem was to determine this variation from observations in the summer half of the year, when the values are all high. This has been done by a method which is substantially that of anamorphic coordinates. In this way, the variation of twenty-two minutes between the two solstices is allowed for in calculating the tables of slack water for 1916 and onward.

For low-water slack, the differences with the time of the tide show a marked alternation with the upper and lower transits of the moon. Up to the present time, this has been allowed for by basing the difference upon the large tides and half tides at the port of reference; but the result was not entirely satisfactory. In the summer, an opportunity was obtained to investigate the matter afresh, during a period of quiet days after the tidal stations for the season were put in running order. After tabulating all the observations in the three years in accordance with the moon's declination, with

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distinction of the transits, an entirely satisfactory result was obtained; and its unusual character brought to light the physical reason why the relation with the large and half tides as formerly used, had given rise to uncertainty. The chief difficulty in arriving at true values was due to the night observations being wanting; as slack water can only be observed in the day time. On this account, when the alternation is strong, the high values are definitely found from a large number of observations, but the low values from very few. A check upon them was obtained, however, by making their difference the same as from the high values to the average, which was found independently. The actual alternation in the differences for successive low-water slacks may amount to a little over an hour. To apply this method of calculation, a complicated technique is required; partly because of the unusual physical characteristics already referred to, and partly because of the adjustments required which vary from month to month according to the position of perigee in relation to declination. With these precautions, the method itself gives excellent results.

Seymour inlet.—Observations of the time of slack water in the entrance to this inlet, which opens off Queen Charlotte sound, were obtained during last season; but it proved to be a problem of unusual difficulty to find any definite relation between slack water and the time of the tide. There is no constant relation with the tide in the open sound, in the vicinity; and a comparison with Port Simpson showed that if the time of slack water were obtained by a constant difference of time with the Port Simpson tide tables, the result might be in error by a whole hour, early or late, when the moon is in high declination.

An extended investigation was therefore undertaken, based upon the interval of time between successive slack waters; this interval alternating from ten hours to fifteen hours in the case of low water, when the moon is in high declination. The intervals between successive tides at all the principal stations were worked out for comparison, under corresponding conditions; in the endeavour to find a tidal station where the behaviour is similar. It was eventually found that the slack at high water could be referred to high water at Clayoquot; but in the case of the slack at low water, the alternation was greater than at Port Simpson and less than at Sand Heads. From this indication and an exhaustive series of comparisons, the method of finding the time of low-water slack was reduced to the following rule: Take the time of high water at Port Simpson and the next following high water at Sand Heads, which is from two to five hours later; and find the mid-time between the two. From this mid-time, subtract six hours five minutes. The result will be the time of low-water slack.

Porlier Pass.—It has recently been discovered that the time of slack water in one pass can be referred to another pass with a better result than can be obtained by referring it directly to the time of the tide. In this way, Porlier pass has now become a standard pass to which slack water in Dodd narrows and Gabriola pass are referred by difference of time. The simultaneous observations required in obtaining these differences, have afforded eighteen additional months of observations in Porlier pass itself. With the former observations obtained in 1906 and 1907, there are now in all thirty-six months to utilize as a basis for the calculation of the slack-water tables for this pass.

As slack water in some of the passes is found by difference of time from Active pass, as well as from Porlier pass, it is evidently desirable to improve the method of calculation for these passes themselves, when so long a series of observations is now available. The new relations discovered recently, gave hope of this; as in the straits and narrows off the gulf of St. Lawrence, it is found that the turn of the current may correspond with high water in the one direction and low water in the other. The investigations for Seymour inlet also threw new light on the relation of slack water to the tide at the various stations, as indicated by the intervals between successive tides. The experience of recent years also makes it clear that slack water may not have any definite relation to the time of the local tide.

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These new methods were applied to slack water in Active and Porlier passes, respectively. The investigations need not be detailed, as the methods themselves have already been explained. The result eventually found was that a marked improvement in the calculations can be gained by referring high-water slack in these passes to the tide of the open Pacific at Clayoquot, whereas low-water slack is in good accord with the tide in the strait of Georgia. The need of treating the large and half tides separately in the calculations has also been looked into, as well as the question of annual variation in the values. It is satisfactory that the calculations for these important passes to which others are referred, will now be placed on the best possible basis.

Nelson, Hudson bay.—At Nelson, the time of high water is calculated from a port of reference, and the time of low water is derived from high water by means of the duration of the fall of the tide. This duration varies throughout the course of the month, and the series of values required for calculation purposes has been improved by utilizing the further observations of 1914 and 1915, giving in all a basis of five seasons' observations for this series.

The height of the tide is calculated with direct relation to the moon. It has been a difficult matter to maintain a uniform datum at Nelson, from which the height is measured; and as the low-water datum of the chart was altered besides, it was advisable to revise the values for height throughout. During four seasons, the observations for this purpose which could be correctly reduced to datum, amounted to nearly eleven and one-half months in all. The variation in height from springs to neaps, required a correction in the period of the anomalistic month for the moon's distance; as the change in height from this cause amounts to 1.80 feet. There was much difficulty in arriving at this correction, owing to the short series of observations in each season. When determined satisfactorily, by methods which it would be too technical to enter upon, the correction was applied to the heights as observed, and the main variation determined during the course of the synodic month, from springs to neaps. This main series, and the correction which over-runs it in another period, enable the height of tide at Nelson to be calculated directly from the moon's position.

It may be considered as quite an achievement to produce tide tables by such methods for a port in an entirely new region. These tide tables have been published since 1914, with gradual improvement; and they now include complete data for the tide in Hudson strait, which have been deduced from early observations as explained in last year's report.

Northumberland strait.—In this strait, the tide undergoes rapid modification; but with further observations in recent years and a careful revision of method, all the harbours along the strait have now been brought into the best relations possible, with the ports of reference.

Pictou, because of its central position in the strait, was early chosen as a secondary port of reference, to equalize the variation in the two directions. The observations of last season have made clear that the whole area from the west shore of Cape Breton island to Baie Verte can be referred to it. The tide at Pictou was formerly calculated from St. Paul island, but the variations were complex; and since Charlottetown was made a principal station, Pictou is calculated from it by means of two series of variable differences, for high water and low water respectively, in the period of the lunar month. The basis for these two series has now been extended to include six seasons of observation, between 1901 and 1915, making twenty-eight months in all, of simultaneous comparison. This will afford a very satisfactory basis for future calculation.

In the western end of Northumberland strait, from cape Tormentine to the west point of Prince Edward island, the tide becomes very complex, with actual change in type from one harbour to another. Careful investigation and many comparisons show that this area can best be referred to Charlottetown; as the diurnal inequality is quite highly developed there as in Hillsborough bay. The time relations with Charlotte-

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town for Summerside, cape Tormentine, and Carleton head opposite, are especially satisfactory; and reliable data for the new car ferry terminals will thus be available.

Rise of the Tide.—In most regions, both in eastern Canada and on the Pacific coast, it is possible to give values for the rise of the tide at springs and neaps, in the usual way. But in some regions, notably in the strait of Georgia, the tide is of such a type that the springs and neaps can no longer be distinguished. So far, a mean value for the rise of the tide has been given in the tide tables; but this is not as serviceable practically as might be desired.

A special reduction was therefore undertaken to obtain a better result. It was first necessary to correlate at the various localities, the datum levels from which the rise is measured; and in doing so, proportionate variations had to be allowed for, which were quite complex owing to the special character of low water. The amount of rise was then made truly comparable by computing for each locality the difference of level between the low-water datum as determined, and the average high water. In this average it was necessary to allow with special care for annual variation as well as for the monthly variations, to obtain comparable results. Without entering upon technicalities, it will suffice to state that as a result ratios were arrived at, which will enable the mariner to know the rise at any locality by simply applying a percentage to the height of the tide as given in the tide tables. The whole region from Victoria and Vancouver to the head of the strait of Georgia, and onward to Queen Charlotte sound, has thus been dealt with consistently.

TIDE LEVELS AND OTHER INFORMATION SUPPLIED.

It is evident that the ultimate basis for extended levelling must be mean sea-level, which can only be obtained from tidal observations. This was pointed out before the geodetic levelling of recent years was commenced; and the foresight in this matter from the beginning, will be seen from a publication by the Tidal Survey, issued in 1903:—

“This survey, as a branch under the Ministry of Marine, has for its primary object the determination of the time-relations of the tide, and the turn of tidal currents, for the information of mariners. The determination of levels is thus quite collateral to the object which the department has in view; but it was very evident that a large amount of important information could be secured by taking more complete levels, and by establishing bench-marks at all tidal stations at which recording instruments were placed, even for a few months. The additional work involved was therefore undertaken from the outset. Eventually as the observations are continued, the value of mean sea level, extreme tide levels, and other factors of importance, are determined with reference to this bench-mark. Although there is as yet no general system of levels in Canada, these results are of value locally in the meantime; and they also furnish a basis for any more extended geodetic levelling which may be undertaken.”

This foresight is now bearing fruit, in furnishing the basis referred to; and it is gratifying to report that another province has been placed in a satisfactory position, in regard to its levels, during the year. Extended levels are being taken throughout Prince Edward island along its railway system; and as a basis for these, the survey was able to furnish to the engineers of the Intercolonial railway an accurate determination of mean sea-level at Charlottetown, referred to a bench-mark there. The determination is made from five complete years of tidal observation, deduced from the height of the tide at every hour, day and night; the value for each of these years being thus the average of 8,760 individual measurements. In addition to the basis, tide levels were also supplied for Summerside and Georgetown, derived from tidal observations in those harbours.

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For the long line of levels extending to Hudson bay, the Topographical Surveys Branch of the Interior Department desired to have a value for mean sea-level at Nelson, to fix the elevation of the extremity of the line. The tidal observations there are much broken; as they have been obtained from three different sources, taken for different purposes; but this survey has taken much trouble to reduce them all to one uniform datum, as otherwise they would be valueless for this object. The determination of mean sea-level was made from three periods of one lunar month each, in different years; and as the values in the individual months differ only by 0.07 foot, or less than an inch, the result is more closely correct than the best levelling can give on a distance of 200 or 300 miles. The resulting value for mean sea level, as furnished to the Topographical Surveys Branch, was given with reference to the permanent bench-mark on an anchor bolt in masonry, and also with reference to the low-water datum as adopted for the charts by the Hydrographic Survey.

There has been considerable correspondence regarding the levels in British Columbia; to correlate the Vancouver city datum with the tide levels, to ascertain the relation of the harbour datum at New Westminster with the low-water datum in the open, and so forth. Information on the levels has also been requested in connection with deep borings and dredging, or to establish a low-water datum.

The new information obtained during the season by this survey, has been communicated to the Hydrographer of the British Navy, when it affords improvement to the data for Canada, which are published with the British Tide Tables. Advance information is often communicated also to railways and manufacturing companies, to which the tide is of importance, for their convenience before it can be issued in the Tide Tables. The information afforded to city and harbour engineers and to other surveys, much of which requires to be worked out from some special point of view, may serve to show the value of this survey to others, in addition to its primary service to navigation.

PUBLICATIONS.

The Tide Tables containing tidal information for Canada are published in two sets, one for the eastern coasts, of which 8,000 are printed, and the other for the Pacific coast which has now been increased to an issue of 15,000. For eastern Canada two abridged editions are issued, of pocket size, one for Quebec and the St. Lawrence and the other for St. John, N.B., and the bay of Fundy. These two additions now amount to 18,000. There is also an abridged edition issued for the southern part of British Columbia, where there is a large demand for local tide tables for Vancouver, the Fraser river, and the passes in that vicinity.

This edition was issued for the first time in 1915 and has met with a very wide circulation, so much so that the issue now requires to be increased to 10,000. It is found very convenient and serviceable by all classes, from pilots to fishermen and for motor-boat traffic, as explained in the last report. The Tide Tables on the Pacific coast are essential to the lumbering industry and the coal trade as well as to the ordinary navigation. The tables are of much use to fishermen, as the best catch is often taken during some special stage of the tide.

The Tide Tables are supplied without charge to all the steamship companies and and to all applicants for them. They are largely circulated through the agencies of the Marine Department, Customs offices, pilot associations, and shipping offices. A large proportion of them are mailed individually, and many are sent in reply to requests received.

The Tide Tables for eight important harbours in eastern Canada and the Pacific coast are now republished by the British Admiralty; together with all new information obtained. Tidal information for the St. Lawrence is furnished annually to the Department of Marine and Fisheries for their publication on the St. Lawrence Ship Channel, for the use of pilots. Tidal information for the summer season is also sent

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locally to Tadoussac, Little Metis, and Murray Bay for convenience to those frequenting these summer resorts. Advance information, based on the observations of last season, has also been forwarded to the shipping interests and manufacturers in Cape Breton and the Saguenay region. In those various ways the information obtained by this survey has a very wide circulation and should reach all who require it.

STAFF.

The staff of this survey for the office and field work, comprises only four in addition to the superintendent; together with the outside tidal observers, who number six in eastern Canada and five on the Pacific coast at the permanent tidal stations. In addition to these, several others are employed locally in the summer season in the observation of tides or currents; and there are engineers as well as other surveys, who gave their co-operation in obtaining observations in the more remote regions.

In the field work last season, Mr. S. C. Hayden supervised the observations of the currents in the passes of British Columbia, fitting out the observers and also inspecting the tidal stations on that coast. In eastern Canada, Mr. H. W. Jones supervised the erection of several summer stations in the Cape Breton region; as well as the current observations already described, in the narrows leading to the Bras d'Or lakes. He also inspected those of the principal stations which required it. In the Saguenay region, Mr. R. B. Lee assisted the superintendent in the establishment of tide gauges and levelling.

During the summer season, the tidal record from the principal stations accumulates and requires attention in the winter. The number of months is thus short in which the reduction of this record and its preparation for analysis has to be made. The observations at the summer stations have also to be dealt with; and the slack water observations in the passes and narrows require to be brought to practical shape for calculation purposes, as explained in the earlier part of this report. There is also the calculation and publication of five sets of Tide Tables to be carried out during the winter months. This work is done by the same staff as above mentioned; with the assistance of Miss N. R. Carter in the reduction, as well as acting as stenographer in carrying on the correspondence.

I have the honour to be, sir,

Your obedient servant,

W. BELL DAWSON,
Superintendent of Tidal Surveys.

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HYDROGRAPHIC SURVEY.

DEPARTMENT OF THE NAVAL SERVICE,

OTTAWA, March 28, 1916.

The Deputy Minister,
Department of Naval Service,
Ottawa.

SIR,—I have the honour to submit a report on the work of the Hydrographic Survey during the fiscal year 1915-16.

During the year no additions were made to the equipment of the survey, but what we have has been kept in first-class condition.

Due to hostilities in Europe the staff has been considerably reduced, Messrs. Knight, Turner, Lawson, Delaute, MacDonald, Miller, and Smith having volunteered and been accepted for service.

The following parties were in the field during the summer of 1915:—

1st.—One party, with the steamer *Acadia*, under Captain Anderson, working in the approach to Halifax harbour.

2nd.—One party, with the steamer *Lillooet*, under Lt.-Commander P. C. Musgrove, R.N., working around Queen Charlotte islands, British Columbia.

3rd.—One party, with the steamer *Cartier*, in command of Mr. Charles Savary, working in the St. Lawrence river, between Father point, pointe des Monts and cape Chat.

4th.—One party, with the steamer *Bayfield*, in charge of Mr. G. A. Bachand, working in lake Ontario.

5th.—One party, with the steamer *La Canadienne*, under Mr. H. D. Parizeau, working in lake Superior.

6th.—A party, using a small chartered schooner, under Mr. Paul Jobin, working in James bay.

7th.—A party looking after the automatic gauges on the Great Lakes and St. Lawrence river.

ATLANTIC COAST SURVEY.

Owing to many complaints, both from officers of the Royal Navy and of the Merchant Marine, about the inaccuracy of soundings in the approach to Halifax harbour, it was decided to undertake an accurate survey of off-shore conditions and the area embraced between Sambro island on the west and Egg island on the east, and extending from 15 to 20 miles off-shore was carefully examined. No shoals were discovered, but the contour lines are now closely charted and show very slight variations from the old ones.

In this work, 1,400 miles of linear sounding, from the deck of the ship, over an area of 700 square miles was done. Observations for latitude and longitude were taken in Findley cove, McNab island, and Day cove, Ship harbour. The latter was connected by triangulation with the positions in Halifax harbour, and a good agreement obtained. The longitudes were obtained by the use of five chronometers and through wireless time signals received from Arlington, Va.

For the triangulation bases were measured at the entrance to Halifax harbour and on the beach inside of Egg island.

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The improvements in Halifax harbour and vicinity, made since the issue of Admiralty Chart No. 311, have been carefully surveyed and will be submitted to the Admiralty for the correction and improvement of the chart of the harbour.

A Canadian chart will be issued showing the result of the offshore work during the past summer.

During the season, considerable work, having no relation to ordinary hydrographic work, was done by this party, such as the establishment of a measured mile in Bedford basin, and detailed examination of the narrow channels of the entrance, for the information of the dockyard officials.

Two cruises, under the direction of Dr. Joham Hjort, were made between Halifax and Newfoundland for the purpose of obtaining offshore soundings and other information relating to an oceanographical study of that portion of the Atlantic ocean in connection with the fisheries of the Dominion. At the close of the surveying season a similar cruise was undertaken by Captain Anderson, acting under instructions from Dr. Hjort.

The *Acadia* arrived at Halifax on the 25th November and was laid up there, the surveying staff returning to Ottawa.

The surveying staff consisted of Captain Anderson and Messrs. L. C. Prittie, J. L. Foreman, and R. J. Fraser. Captain Anderson reports very favourably of his staff and Captain Robson, they having rendered him every assistance in their power.

I regret to say that considerable difficulty was experienced with the boilers and engines during the season, and between five and six weeks were lost during this time.

PACIFIC COAST SURVEY.

This party, under Lieut.-Commander P. C. Musgrave, R.N., with Messrs. O. R. Parker and L. R. Davies, as assistants, Captain Griffiths, sailing master, and Mr. A. Borrowman, first engineer, left Esquimalt on board the steamer *Lillooet* on the 13th April.

Owing to Lieut.-Commander Knight being still on service with the *Rainbow* and Mr. J. A. Turner with the forces in Europe, it was decided to lay up the schooner *Naden* at New Westminster.

The party first made a survey of Fisherman bay, at the north end of Vancouver island, and examined a reported danger said to lie 18 miles west of Triangle island, and another one about 9 miles southwest of the same spot, but no indication of any obstruction could be found.

In the early days of May a survey was made of a large portion of Millbank sound and a hunt was made for a shoal marked in that bay, but no sign of it could be found.

Later on a survey was made of "Blind Slue" and of the western portion of DeHorsey island, in the approach to Skeena river.

Between the 16th and 20th of May an officer of the Canadian Geodetic Survey joined the party and a cruise was made to Queen Charlotte islands with the intention of selecting a point for the main triangulation along that coast.

Between the 20th May and the 30th October the party was engaged in surveying various points around the Queen Charlotte islands and of the east side of Hecate strait. The east side of Queen Charlotte islands has now been surveyed for a distance of 10 miles offshore, between Rose spit and Cumshewa head. A small amount of sounding was done at the western end of Dixon entrance and in the approach to port Louis, whilst the coast line of the west side of Graham island has been extended from Frederick island to port Louis.

Considerable examination was done extending the survey of Skidegate inlet to the west end of East narrows, and in this connection the work of marking this channel by buoys and beacons, for the Department of Marine, was undertaken.

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Some further surveying was done for a distance of 8 miles offshore, between Fan island and White rock, at the entrance to Browning passage.

To summarize, during the season, about 90 miles of coast line were surveyed, some 276 square miles were sounded and 930 linear miles of sounding were done from both the ship and boats. To convey some idea of the difficulties of surveying on this coast, I might mention that of the 168 working days, sixty were lost through bad weather, of which twenty-six were rain, but on the whole the season was rather better than 1914, because the party had eighty days of actual work as compared with only fifty in 1914.

ST. LAWRENCE RIVER SURVEY.

Mr. Charles Savary, being in charge of the survey work at the lower entrance to the St. Lawrence river, had for assistants, Messrs. E. Chysens, M. A. McKinnon, and C. Smith, with Capt. H. J. McGough as sailing master, and Mr. E. Belanger as chief engineer, on board the steamer *Cartier*.

The steamer was used in the winter of 1914-15 in the examination service at the entrance to the bay of Fundy and for this reason was not able to be outfitted and made available for work until the 23rd June when she left Quebec to survey between Matane and cape Chat, on the south shore, and pointe des Monts on the north shore. This work is just about completed, and a sheet embracing the above mentioned district will be handed to the King's Printer this spring.

During the season Mr. Savary and party traversed 90 miles of ocean line, sounding 1,000 miles from the ship's deck and 400 miles from the boats.

Returning in the autumn the steamer visited Chicoutimi to locate the buoys in the river there for placing on a new chart being compiled. The old surveys which had been used for this work were found to be quite inaccurate, and more work was therefore necessary. It is hoped that this chart will be forwarded to the King's Printer in the spring.

Mr. Savary reports that his staff and ship's officers have given him valuable assistance during the season. Mr. Smith enlisted for service overseas at the close of the season.

The steamer is laid up at Quebec, and only slight repairs to her engines will be required this winter.

LAKE ONTARIO SURVEY.

This survey, under Mr. G. A. Bachand, is composed of Messrs. J. W. Beauchemin, E. B. MacColl, and W. K. Willis as assistant surveyors; Captain McQuade, sailing master, and John Nisbet, chief engineer. The party fitted out the steamer *Bayfield* at the lighthouse depot, Prescott, Ont., and left there on the 26th April last. The season between this date and the 20th September was taken up in completing the survey of the west end of lake Ontario, Hamilton bay, Port Dalhousie, Port Credit, Oakville, and Bronte harbours; this completes the survey of the lake, and charts of these harbours as well as the coast will be placed in the hands of the King's Printer this spring.

On the 21st September the party left for Kingston and started a survey of that harbour and approach, working from Snake island to Cataragui bridge and between Bell point on Wolfe island to point Pleasant on the west. This work will be completed this spring.

During the season, in addition to the triangulation necessary for the work, there were 90 miles of traversing done, 460 miles of sounding from boats and 280 miles from the deck of the ship.

The party returned to Prescott on the 30th October, and the ship laid up at the Dominion lighthouse depot for the winter.

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LAKE SUPERIOR SURVEY.

This work is in charge of Mr. H. D. Parizeau, who has for assistants, Messrs. H. H. Lawson, F. R. Mortimer and H. L. Leadman, but the former joined the overseas forces last winter and was therefore not available for work during the season. The party uses the steamer *La Canadienne*, with Captain Playter as sailing master, and Mr. N. C. Munro as chief engineer.

After some slight work surveying and locating changes and improvements in Owen Sound harbour the party left the latter place on the 28th April and reached Byng inlet the following morning. Work was resumed there on the plan of Byng inlet, which was started in the autumn of 1914, and was completed on the 5th June, and a chart has been prepared, which is now with the King's Printer for publication.

Leaving Byng inlet the party proceeded to Little Current to inspect the positions of the buoys in that channel that they might be in accordance with the new charts recently issued.

On the trip between Little Current and Sault Ste. Marie opportunity was taken to examine some suspicious soundings in False Detour channel and off the south shore of Drummond island. In one case it was found necessary to remove a shoal printed on the chart and in another case to register a shoal that had been uncharted.

With the assistance of the steamer's crew a new automatic gauge was installed at Michipicoten harbour, in accordance with the desire of the International Commission and its order relating to the control of the levels of lake Superior.

Regular surveying work was resumed on the 15th of June at ship sounding off-shore between Oiseaux bay and Copper island. The survey of the north shore of lake Superior is now completed from Pigeon bay as far east as Otter head, except for the large Nipigon and Black bays. There remains only one shoreline between Otter head and cape Gargantua and around Michipicoten and Caribou islands.

When autumn weather set in, about the middle of September, it was deemed advisable to move the steamer *La Canadienne* to quieter waters, and a triangulation of Nipigon bay was undertaken and completed.

During the season, Mr. Parizeau and party traversed 43 miles of coast line, sounded 624 miles from boats and 535 miles from the deck of the ship. The party reached Owen Sound on the 30th October, and laid up the steamer there, the officers returning to Ottawa.

After laying up the steamer, Mr. Parizeau visited Key harbour and searched for a new danger reported there, on which a vessel had struck, but ascertained that the accident was due to a misplaced buoy. He also visited Penetanguishene harbour and made a survey of changes that have taken place there since the last issue of the chart.

JAMES BAY.

Mr. Paul Jobin was again placed in charge of the work in James bay, with Mr. R. T. Bowes, assistant.

The party, consisting of the surveyors and five men, left Cochrane on the 6th of May, proceeded down the Moose river and arrived at Moose Factory on the 12th. The launch which had been left there was first overhauled and a small schooner hired from Revillon Frères to be used for a houseboat for the party.

A survey was made of the mouth of Moose river, and a plan of this has been prepared. Upon the completion of this work the party moved to Strutton and Charlton islands to do some sounding in Charlton sound, which was completed on the 21st September. The party then returned to Ottawa via Moose Factory and Cochrane, arriving here on the 15th of October.

An automatic gauge was erected at the mouth of Moose river, and two months' record of the tides obtained; this has been handed over to the Superintendent of the

Tidal Survey. Conditions for navigation were generally good this year; the ss. *Bona-ventura* arrived at Strutton island on the 3rd August, having seen only a small quantity of ice in Hudson strait.

AUTOMATIC GAUGES.

The following eleven gauges were operated on the Great Lakes during the year 1915:

Port Arthur.....	Lake Superior.....	Jan.	1 to Dec. 31.
Michipicoten Harbour...	"	June	15 to Dec. 31 (new).
Sault Ste. Marie.....	Above Locks.....	Jan.	1 " 31.
Sault Ste. Marie.....	Below Locks.....	Jan.	1 " 31.
Collingwood.....	Georgian Bay.....	May	22 to July 27.
		Nov.	22 to Dec. 31.
Goderich.....	Lake Huron.....	May	21 " 15.
Isle Aux Peches.....	Detroit River.....	Jan.	1 " 31.
Fighting Island.....	"	Jan.	1 " 31.
Port Colborne.....	Lake Erie.....	Jan.	1 " 31.
Port Dalhousie.....	Lake Ontario.....	May	20 " 15.
Kingston.....	"	Jan.	1 " 31.

During November, 1915, the Collingwood gauge was installed in such a way as to secure complete yearly records. The only gauges on the Great Lakes not now obtaining yearly records are Goderich and Port Dalhousie, but arrangements have been made for such an installation of the Port Dalhousie gauge at Port Weller, when the approaches to the New Welland canal are completed. Records of the Michipicoten harbour gauge cannot be reduced to mean sea-level until such time as an elevation for our bench-mark is obtained from the Geodetic Survey.

On the St. Lawrence river the following sixteen gauges were operated for the Montreal-Quebec Ship Channel Commission and the Montreal Water Level Commission:—

Pointe Claire.....	Lake St. Louis.....	May	24 to Dec. 31.
Verdun.....	St. Lawrence River.....	Aug.	20 " 31 (new).
Montreal Harbour.....	"	April	20 " 31.
Longue Pointe.....	"	"	21 " 31.
Varennas.....	"	"	22 " 7.
Vercheres.....	"	"	23 " 6.
Lanoraie.....	"	"	17 " 6.
Sorel.....	"	"	10 " 6.
Lake St. Peter.....	"	"	17 " 2.
Three Rivers.....	"	"	14 " 2.
Batiscan.....	"	"	21 " 3.
Cap a la Roche.....	"	May	10 " 3 (new).
Richelieu Rapids.....	"	"	12 " 3.
Pointe Platon.....	"	April	21 to Nov. 30.
Neuville.....	"	"	22 to Dec. 2.
St. Nicholas.....	"	"	23 " 4.

The above gauges were operated in a more satisfactory manner than in previous years, and in very few cases were there any breaks to cause incomplete records. The Pointe Claire and Verdun gauges are still operating to obtain winter records. The Montreal and Longue Pointe gauges were operated till January 10, 1916, when high water made it necessary to remove them before flooding.

All gauges on the St. Lawrence river are now connected with authentic Canadian bench-marks with elevations by latest adjusted level line.

During 1915 there was an addition of five new gauges, making twenty-seven during the summer months and eleven during the whole year.

The automatic water gauge work is conducted by Mr. C. A. Price, assisted by Messrs. A. R. Lee, Wm. J. Miller (on active service), C. G. Smith (until June 11, 1915), and C. F. Hannington (from July 12, 1915).

Attached are the following appendices, giving records obtained from the gauges:—

I. Table showing corrected elevations of Bench Marks and corrections to be applied to Water Surface Elevations of Lower St. Lawrence, as given in reports of 1913 and 1914.

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II. Monthly Mean Water Surface Elevations of the Great Lakes, for 1915, referred to United States datum or mean sea level.

III. Daily mean elevation of Lake St. Louis at Pointe Claire.

IV. Daily mean elevation of St. Lawrence river at Verdun.

V. Daily mean elevation of St. Lawrence river at Montreal.

VI. Daily mean elevation of St. Lawrence river at Longue Pointe.

VII. Daily mean elevation of St. Lawrence river at Varennes.

VIII. Daily mean elevation of St. Lawrence river at Verchères.

IX. Daily mean elevation of St. Lawrence river at Lanoraie.

X. Daily mean elevation of St. Lawrence river at Sorel.

XI. Daily mean elevation of Lake St. Peter at Range Light No. 2.

In closing this report I have to express my thanks to all the members of the staff for the valuable service they have rendered during the past year.

I have the honour to be, sir,

Your obedient servant,

WM. J. STEWART,

Hydrographer.

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CORRECTED ELEVATIONS of Bench-marks, and changes to be applied to Water Surface Elevations, of Lower St. Lawrence river, given in the Reports of 1913 and 1914.

Location.	Old Elevation of Bench-mark used till Jan. 1, 1915.	New Elevation of Bench-mark used since Jan. 1, 1915.	Correction for Readings 1913 and 1914.
Montreal.....	36.46	36.46	.....
Longue Pointe.....	40.66	40.477	— .183
Varrennes.....	32.451	31.97	— .481
Vercheres.....	30.844	30.78	— .064
Lanoraie.....	37.399	37.399	.....
Sorel.....	46.80	46.80	.....
Three Rivers.....	26.526	26.403	— .123
Batiscan.....	26.70	26.565	— .135
Pointe Platon.....	29.736	29.68	— .056
Neuville.....	56.381	56.481	+ .10
St. Nicholas.....	16.101	16.19	+ .089
St. Romuald.....	29.43	29.53	+ .10

WATER SURFACE ELEVATIONS of "Great Lakes " for 1915, by Automatic Water Gauge, and Referred to Mean Sea-level.

	Location.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
Lake Superior.....	Port Arthur.....	Feet. 601.72	Feet. 601.59	Feet. 601.32	Feet. 601.19	Feet. 601.51	Feet 601.91	Feet. 602.24	Feet. 602.29	Feet. 602.34	Feet. 602.63	Feet. 602.61	Feet. 602.53	Feet. 601.99
St. Mary's River.....	Above Locks	601.11	600.91	600.90	600.78	601.10	601.36	601.79	601.83	601.80	602.11	602.24	602.05	601.50
	Below Locks.....	581.61	581.66	581.36	580.75	580.77	581.01	581.22	581.34	581.35	581.39	581.32	581.03	581.23
Georgian Bay.....	Collingwood.....					579.59 from 22	579.69	579.84 till 28	gauge re moved			579.66 from 20	579.42	
Lake Huron.....	Goderich.....					579.63 from 21	579.76	579.91	580.03	579.98	579.86	579.67	579.61 till 14	579.81
Detroit River.....	Isle aux Peches.....	573.16	573.76	573.28	573.83	574.12	574.31	574.52	574.73	574.61	574.35	573.91	573.88	574.04
	Fighting Island.....	572.67	573.27	572.84	573.28	573.56	573.76	573.97	574.19	574.09	573.80	573.30	573.26	573.50
Lake Erie.....	Port Colborne.....	571.02	571.11	571.26	571.24	571.36	571.58	571.80	572.08	571.95	571.84	571.72	571.40	571.53
	Port Dalhousie.....					245.13 from 20	245.07	245.07	245.44	245.38	245.18	244.84	244.73 till 14	245.11
Lake Ontario..	Kingston.....	244.59	244.76	245.07	245.00	245.01	244.99	245.02	245.33	245.35	245.20	244.89	244.68	244.99

DAILY MEAN Water Surface Elevations of Lake St. Louis, at Pointe Claire, Que. Elevations are above Mean Sea-level and are referred to Bench-mark CCCCIII on Southeast corner of Roman Catholic church. Elevation, 83.95.

Days.	1915.							
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1		68.37	67.98	67.31	67.82	67.42	67.44	67.38
2		68.30	67.92	67.29	67.80	67.35	67.47	67.30
3		68.28	67.92	67.23	67.77	67.37	67.43	67.26
4		68.24	67.93	67.10	67.73	67.50	67.39	67.21
5		68.21	67.98	67.13	67.69	67.63	67.23	67.10
6		68.17	67.94	67.24	67.70	67.73	67.17	67.07
7		68.16	67.95	67.35	67.70	67.75	67.12	
8		68.12	67.88	67.43	67.71	67.72	67.13	
9		68.09	67.77	67.58	67.74	67.71	67.15	
10		68.08	67.73	67.68	67.71	67.67	67.24	
11		68.00	67.75	67.73	67.67	67.68	67.20	
12		67.98	67.80	67.76	67.60	67.72	67.11	
13		67.97	67.80	67.74	67.50	67.74	67.16	66.95*
14		68.07	67.78	67.74	67.50	67.72	67.26	67.02
15		68.16	67.77	67.75	67.56	67.67	67.33	67.13
16		68.23	67.72	67.78	67.62	67.55	67.31	67.45
17		68.22	67.67	67.76	67.65	67.47	67.29	67.69
18		68.16	67.66	67.71	67.61	67.52	67.24	67.58
19		68.12	67.68	67.70	67.53	67.56	67.04	67.34
20		68.11	67.74	67.72	67.55	67.56	67.10	67.31
21		68.08	67.70	67.75	67.54	67.54	67.41	67.32
22		67.99	67.67	67.77	67.53	67.51	67.55	67.24
23	68.74*	67.92*	67.63	67.91	67.53	67.47	67.56	67.16
24	68.75	67.99	67.58	68.06	67.51	67.39	67.48	67.21
25	68.75	68.04	67.51	68.14	67.46	67.44	67.31	67.25
26	68.68	68.04	67.47	68.10	67.38	67.47	67.18	67.25
27	68.59	68.07	67.45	68.04	67.47	67.51	67.12	67.26
28	68.51	68.11	67.42	67.90	67.47	67.52	67.16	67.33
29	68.49	68.11	67.42	67.80	67.41	67.49	67.21	67.30
30	68.41	68.06	67.42	67.82	67.43	67.43	67.33	67.59
31	68.37		67.39	67.87		67.41		67.88
Mean.....	68.59	68.12	67.66	67.67	67.60	67.56	67.27	67.30

* Denotes Mean of less than 24 hourly readings.

SESSIONAL PAPER No. 38

DAILY MEAN Water Surface Elevations of St. Lawrence River taken at Verdun, Que.
Elevations are above Mean Sea-level and are referred to Bench-mark "V4" on
R. Bennett's house opposite wharf. Elevation, 58.07.

Days.	1915.							
	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....					34.25*	34.04	34.05	33.98
2.....					34.24*	34.04	34.07	33.98
3.....					34.23	34.02	34.06	33.99
4.....					34.22	34.07	34.05	33.98
5.....					34.20	34.11	34.03	33.96
6.....					34.16	34.12	34.04	33.95
7.....					34.17	34.14	34.01	33.95
8.....					34.17	34.16	33.99	33.95
9.....					34.17	34.16	34.00	33.95
10.....					34.18	34.14	34.00	33.95
11.....					34.17	34.14	34.00	33.94
12.....					34.14	34.15	33.99	33.92
13.....					34.12	34.16	33.99	33.91
14.....					34.11	34.16	33.99	33.94
15.....					34.12	34.15	33.99	34.03
16.....					34.13	34.13	34.00	34.20
17.....					34.13	34.09	33.99	34.39*
18.....					34.13	34.09	33.98	34.27
19.....					34.13	34.09	33.94	34.13
20.....					34.10	34.09	33.93	34.05
21.....					34.10	34.09	33.96	34.08
22.....					34.11	34.09	34.03	34.05
23.....					34.10	34.08	34.05	33.99
24.....					34.10	34.06	34.03	33.97
25.....					34.10	34.06	34.02	33.96
26.....					34.04	34.07	34.00	33.96
27.....				34.36*	34.01	34.07	33.98	34.01
28.....				34.32	34.03	34.07	33.98	33.99
29.....				34.27	34.03	34.07	33.97	34.06
30.....				34.25	34.03	34.06	33.97	34.74
31.....				34.26		34.05		34.76
Mean.....					34.13	34.09	34.00	34.06

* Denotes Mean of less than 24 hourly readings.

DAILY MEAN Water Surface Elevations of St. Lawrence River taken at Montreal, Que.,
(Foot of Lachine Canal). Elevations are above Mean Sea-level and are referred
to Bench-mark No. 637. Elevation, 36.46.

Days.	1915.								
	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		23.25	21.06	20.45	19.31	19.87	19.33	18.86	18.85
2		23.32	21.41	20.52	19.46	19.72	19.31	18.90	18.87
3		23.38	21.01	20.37	19.31	19.70	19.15	19.04	18.81
4		23.11	20.78	20.23	19.00	19.62	19.12	19.00	18.78
5		22.85	20.59	19.99	18.89	19.50	19.18	19.14	18.75
6		22.56	20.41	19.90	18.93	19.44	19.55	19.01	18.89
7		22.33	20.28	19.90	19.00	19.48	19.67	18.87	18.87
8		22.16	20.10	19.94	19.10	19.58	19.68	18.94	18.83
9		22.06	20.23	19.91	19.38	19.63	19.76	18.97	19.03
10		22.11	20.20	19.74	19.63	19.66	19.78	19.08	19.04
11		22.18	20.08	19.65	19.66	19.67	19.69	19.06	18.83
12		22.05	20.04	19.71	19.72	19.65	19.70	18.91	18.58
13		22.34	19.99	19.87	19.75	19.68	19.76	18.78	18.63
14		22.19	20.16	19.88	19.73	19.58	19.69	18.73	18.97
15		22.09	20.27	19.90	19.76	19.59	19.75	18.79	18.80
16		21.93	20.37	19.86	19.80	19.61	19.45	18.93	18.85
17		21.80	20.45	19.84	19.99	19.57	19.13	18.80	19.07
18		21.70	20.49	19.73	19.84	19.48	19.18	18.65	19.55
19		21.78	20.14	19.68	19.71	19.30	19.17	18.87	19.25
20	21.35*	21.68	20.21	19.71	19.65	19.36	19.27	18.71	19.16
21	21.29	21.47	20.30	19.72	19.63	19.29	19.29	18.86	19.18
22	21.09	21.17	20.27	19.61	19.67	19.48	19.31	19.13	19.16
23	20.97	21.21	20.42	19.53	19.76	19.41	19.31	19.22	19.23
24	21.04	21.24	20.37	19.40	20.04	19.39	19.18	19.22	19.26
25	21.12	21.29	20.44	19.43	20.22	19.36	19.16	19.07	19.25
26	21.19	21.46	20.40	19.41	20.33	19.17	19.10	19.01	19.33
27	21.49	21.31	20.39	19.35	20.28	19.57	19.15	18.94	19.11
28	21.82	21.23	20.46	19.31	20.14	19.53	19.18	18.76	19.16
29	21.91	21.35	20.51	19.35	20.02	19.42	19.14	18.81	19.25
30	22.73	21.12	20.46	19.32	19.95	19.33	19.13	18.74	19.44
31...		21.11		19.28	20.03		19.01		19.81
Mean.....	21.45	21.96	20.41	19.76	19.67	19.52	19.36	18.93	19.05

* Denotes Mean of less than 24 hourly readings.

SESSIONAL PAPER No. 38

DAILY MEAN Water Surface Elevations of St. Lawrence River at Longue Pointe, Que.
Elevations are above Mean Sea-level and are referred to Copper Plug Bench-mark
in southeast corner of Longue Pointe Asylum pump-house. Elevation, 40.477.

Days.	1915.								
	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1..		22.28	19.84	19.23	18.10	18.57	18.09	17.59	17.60
2.....		22.33	20.22	19.21	18.22	18.41	18.10	17.56	17.62
3..		22.39	19.80	19.15	18.09	18.39	17.94	17.71	17.59
4..		22.09	19.55	19.02	17.76	18.30	17.89	17.70	17.57
5..		21.79	19.36	18.75	17.64	18.19	17.91	17.87	17.57
6..		21.47	19.19	18.58	17.66	18.12	18.27	17.80	17.71
7.....		21.21	19.04	18.59	17.73	18.14	18.40	17.70	17.71
8..		21.00	18.82	18.63	17.84	18.24	18.43	17.77	17.66
9..		20.89	18.94	18.61	18.09	18.31	18.52	17.79	17.86
10..		20.89	18.93	18.49	18.33	18.37	18.56	17.88	17.87
11.....		20.96	18.82	18.43	18.34	18.38	18.47	17.88	17.67
12.....		20.84	18.81	18.46	18.38	18.38	18.44	17.75	17.43
13.....		21.08	18.78	18.62	18.44	18.43	18.49	17.57	17.44
14..		21.02	18.88	18.63	18.46	18.35	18.42	17.52	17.79
15..		20.92	18.98	18.64	18.49	18.35	18.49	17.57	17.60
16..		20.76	19.06	18.62	18.50	18.31	18.22	17.68	17.68
17.....		20.62	19.15	18.63	18.68	18.25	17.91	17.58	17.92
18.....		20.48	19.21	18.52	18.55	18.18	17.92	17.41	18.38
19 ..		20.54	18.90	18.43	18.43	18.03	17.89	17.70	18.12
20.....		20.46	18.95	18.43	18.35	18.05	17.97	17.57	17.99
21.....	20.02*	20.23	19.01	18.46	18.34	17.97	18.00	17.65	18.02
22..	19.90	19.92	18.98	18.36	18.39	18.17	18.03	17.86	18.01
23.....	19.74	19.95	19.19	18.28	18.46	18.11	18.04	17.95	18.12
24.....	19.80	19.97	19.15	18.17	18.69	18.06	17.94	18.00	18.17
25.....	19.89	20.00	19.21	18.19	18.85	18.11	17.91	17.86	18.15
26.....	19.96	20.18	19.18	18.17	19.00	17.94	17.84	17.80	18.24
27.....	20.28	20.07	19.15	18.13	18.98	18.33	17.87	17.74	18.00
28.....	20.68	20.00	19.21	18.08	18.86	18.30	17.91	17.58	18.00
29.....	20.80	20.14	19.25	18.12	18.77	18.20	17.86	17.62	18.11
30..	21.66	19.94	19.22	18.10	18.68	18.11	17.84	17.49	18.38
31..		19.92		18.08	18.74		17.74		18.86
Mean.....	20.27	20.79	19.16	18.51	18.38	18.24	18.11	17.71	17.90

* Denotes Mean of less than 24 hourly readings.

DAILY MEAN Water Surface Elevations of St. Lawrence River taken at Varennes, Que.
Elevations are above Mean Sea-level and are referred to Crow's foot Bench-mark
on stone wall in rear of wharf. Elevation, 31.97.

Days.	1915								
	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		21.21	18.42	17.84	16.56	17.00	16.50	15.94	15.97
2.		21.24	18.91	17.95	16.66	16.81	16.54	15.84	16.04
3.		21.28	18.46	17.76	16.56	16.78	16.36	16.01	16.02
4.		20.95	18.13	17.58	16.22	16.68	16.28	16.03	16.01
5.		20.61	17.91	17.25		16.58	16.27	16.26	16.04
6.		20.23	17.71	16.99		16.51	16.63	16.23	16.21
7.		19.91	17.52	16.99		16.52	16.81	16.15	
8.		19.69	17.25	17.06	16.20	16.60	16.87	16.25	
9.		19.55	17.37	17.06	16.43	16.71	16.98	16.25	
10.		19.51	17.35	16.96	16.71	16.79	17.05	16.29	
11.		19.54	17.27	16.90	16.76	16.81	16.97	16.30	
12.		19.42	17.26	16.91	16.81	16.83	16.90	16.18	
13.		19.71	17.30	17.08	16.88	16.91	16.94	15.94	
14.		19.64	17.32	17.12	16.91	16.82	16.87	15.86	
15.		19.52	17.48	17.13	16.96	16.80	16.92	15.79	
16.		19.37	17.59	17.12	16.95	16.75	16.64	15.99	
17.		19.24	17.70	17.11	17.12	16.66	16.29	15.91	
18.		19.06	17.75	17.00	16.99	16.59	16.30	15.74	
19.		19.07	17.40	16.88	16.86	16.44	16.27	16.15	
20.		18.98	17.47	16.86	16.76	16.43	16.35	16.06	
21.	18.56*	18.76	17.53	16.89	16.75	16.34	16.40	16.05	
22.	18.47	18.41	17.53	16.80	16.83	16.54	16.43	16.21	
23.	18.29	18.42	17.79	16.71	16.85	16.51	16.44	16.32	
24.	18.38*	18.41	17.76	16.62	17.10	16.45	16.39	16.41	
25.	18.54*	18.45	17.81	16.64	17.27	16.52	16.35	16.30	
26.	18.59	18.63	17.76	16.64	17.43	16.37	16.31	16.27	
27.	18.99*	18.54	17.74	16.59	17.43	16.75	16.29	16.24	
28.	19.43	18.48	17.79	16.54	17.35	16.73	16.30	16.04	
29.	19.60	18.68	17.81	16.57	17.27	16.63	16.26	16.09	
30.	20.50	18.49	17.80	16.56	17.17	16.54	16.20	15.87	
31.		18.46		16.53	17.20		16.10		
Mean.		19.40	17.70	16.99	16.89	16.65	16.52	16.10	

* Denotes Mean of less than 24 hourly readings.

SESSIONAL PAPER No. 38

DAILY MEAN Water Surface Elevations of St. Lawrence River taken at Verchères, Que.
Elevations are above Mean Sea-level and are referred to Crow's foot Bench-mark
on North side of windmill near wharf. Elevation, 30.78.

Days.	1915.								
	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1..		20.38	17.34	16.67	15.46	15.78	15.30	14.69	14.70
2..		20.41*	17.78	16.80	15.54	15.57	15.35	14.57	14.74
3..			17.34	16.59	15.45	15.52	15.14	14.74	14.75
4..			16.98	16.39	15.10	15.40	15.06	14.78	14.76
5..		19.61*	16.74	16.06	14.91	15.30	15.05	15.07	14.83
6..		19.31	16.52	15.74	14.86	15.25	15.36	15.07	
7..		18.97	16.32	15.70	14.90	15.28	15.58	15.02	
8..		18.71	16.07	15.75	15.00	15.37	15.67	15.14	
9..		18.55	16.15	15.77	15.25	15.49	15.80	15.15	
10..		18.49	16.15	15.71	15.52	15.59	15.88	15.15	
11..		18.51	16.09	15.67	15.56	15.62	15.81	15.17	
12..		18.40	16.09	15.69	15.60	15.65	15.74	15.06	
13..		18.69	16.15	15.87	15.67	15.74	15.76	14.79	
14..		18.63	16.17	15.93	15.71	15.66	15.67	14.66	
15..		18.52*	16.30	15.94	15.77	15.63	15.69	14.69	
16..		18.36	16.31	15.96	15.76	15.55	15.41	14.78	
17..		18.21	16.41	15.96	15.89	15.44	15.05	14.68	
18..		17.99	16.47	15.86	15.78	15.35	15.04	14.52	
19..		17.98	16.25	15.72	15.64	15.21	15.02	14.99	
20..		17.88	16.20	15.68	15.54	15.21	15.09	14.97	
21..		17.67	16.25	15.70	15.53	15.16	15.15	14.91	
22..		17.34	16.27	15.62	15.60	15.35	15.19	14.99	
23..	17.17*	17.30	16.56	15.53	15.63	15.33	15.19	15.11	
24..	17.27	17.26	16.55	15.44	15.85	15.25	15.18	15.23	
25..	17.40	17.32	16.61	15.46	16.03	15.34	15.15	15.14	
26..	17.51	17.49	16.53	15.46	16.18	15.21	15.13	15.12	
27..	17.91	17.42	16.51	15.43	16.22	15.57	15.07	15.07	
28..	18.43	17.40	16.55	15.42	16.14	15.55	15.06	14.86	
29..	18.69	17.62	16.58	15.46	16.08	15.44	15.02	14.91	
30..	19.65	17.46	16.58	15.46	15.99	15.36	14.93	14.65	
31..		17.44		15.44	15.99		14.83		
Mean....		18.25	16.49	15.00	15.62	15.44	15.30	14.92	

Denotes Mean of less than 24 hourly readings.

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DAILY MEAN Water Surface Elevations of St. Lawrence River taken at Lanoraie, Que.,
Elevations are above Mean Sea-level and are referred to Bench-mark top of iron
pin in Hydrographic Station west of approach to Lanoraie wharf. Elevation,
37,399.

Days.	1915								
	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		19.24	15.86	15.18	13.89	14.05	13.63	12.92	12.92
2.....		19.30	16.32	15.30	13.92	13.81	13.68	12.77	12.96
3.....		19.23	15.87	15.07	13.82	13.71	13.45	12.92	13.00
4.....		18.83	15.44	14.83	13.47	13.59	13.35	13.01	13.04
5.....		18.47	15.15	14.46	13.23	13.48	13.35	13.36	13.20
6.....		18.02	14.89	14.00	13.16	13.45	13.59	13.46	
7.....		17.60	14.68	13.94	13.18	13.51	13.85	13.48	
8.....		17.41	14.44	14.00	13.29	13.63	14.02	13.62	
9.....		17.15	14.47	14.04	13.57	13.81	14.18	13.64	
10..		17.04	14.51	14.03	13.84	13.95	14.28	13.60	
11..		16.99	14.48	14.04	13.89	14.00	14.24	13.58	
12..		16.92	14.52	14.09	13.95	14.03	14.14	13.47	
13..		17.18	14.61	14.27	14.03	14.15	14.14	13.14	
14..		17.15	14.61	14.34	14.10	14.08	14.03	12.95	
15..		17.01	14.74	14.35	14.17	14.03	13.98	12.96	
16..		16.88	14.72	14.40	14.13	13.92	13.69	13.10	
17..	16.84*	16.75	14.79	14.42	14.18	13.76	13.31	12.95	
18..	16.61	16.50	14.84	14.31	14.05	13.65	13.27	12.76	
19..	16.38	16.41	14.72	14.11	13.93	13.53	13.30	13.37	
20.....	16.27	16.27	14.59	14.03	13.82	13.52	13.37	13.45	
21..	16.16	16.06	14.61	14.05	13.81	13.53	13.45	13.30	
22..	15.92	15.74	14.70	13.97	13.89	13.66	13.48	13.26	
23..	15.71	15.64	15.03	13.89	13.95	13.68	13.46	13.40	
24..	15.76	15.58	15.06	13.82	14.14	13.60	13.53	13.55	
25.....	15.92	15.63	15.09	13.84	14.35	13.70	13.52	13.50	
26..	16.07	15.80	15.00	13.88	14.50	13.62	13.52	13.48	
27.....	16.55	15.75	14.96	13.87	14.54	13.98	13.42	13.43	
28..	17.11	15.83	15.02	13.89	14.47	13.90	13.36	13.24	
29.....	17.46	16.09	15.05	13.94	14.43	13.80	13.29	13.25	
30..	18.46	16.01	15.06	13.96	14.38	13.72	13.17	12.96	
31..		15.98		13.93	14.29		13.09		
Mean.....	16.52	16.92	14.93	14.21	13.95	13.76	13.62	13.26	

* Denotes Mean of less than 24 hourly readings.

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DAILY MEAN Water Surface Elevations of St. Lawrence River taken at Sorel, Que.
Elevations are above Mean Sea-level and are referred to Canadian Bench-mark
MCCCVII on northwest side of entrance to Sorel Post Office. Elevation, 46.80.

Days.	1915								
	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1..		18.83	15.39	14.73	13.50	13.65	13.22	12.51	12.52
2..		18.91	15.83	14.86	13.51	13.41	13.25	12.37	12.55
3..		18.83	15.39	14.62	13.42	13.29	13.02	12.51	12.60
4..		18.45	14.95	14.38	13.08	13.15	12.92	12.60	12.67
5..		18.04	14.65	14.02	12.83	13.05	12.93	12.97	12.83
6.....		17.57	14.40	13.57	12.75	13.03	13.13	13.09	
7.....		17.13	14.18	13.47	12.76	13.08	13.42	13.13	
8.....		16.86	13.96	13.51	12.87	13.21	13.62	13.28	
9..		16.68	13.97	13.58	13.14	13.41	13.77	13.30	
10.....	16.81*	16.56	14.02	13.59	13.41	13.57	13.88	13.22	
11.....	17.09	16.50	14.00	13.61	13.47	13.62	13.85	13.21	
12..	17.64	16.45	14.05	13.66	13.54	13.65	13.74	13.10	
13..	17.65	16.67	14.15	13.83	13.62	13.78	13.75	12.78	
14.....	17.40	16.65	14.15	13.91	13.68	13.71	13.62	12.56	
15..	17.05	16.52	14.27	13.92	13.76	13.66	13.53	12.56	
16....	16.71	16.40	14.25	13.98	13.74	13.53	13.25	12.70	
17.....	16.44	16.27	14.31	13.98	13.77	13.36	12.87	12.54	
18.....	16.16	16.02	14.35	13.88	13.65	13.24	12.83	12.38	
19.....	15.92	15.91	14.27	13.70	13.52	13.12	12.88	12.99	
20..	15.79	15.76	14.13	13.61	13.41	13.12	12.95	13.12	
21.....	15.68	15.53	14.13	13.63	13.39	13.16	13.03	12.96	
22.....	15.43	15.23	14.23	13.55	13.47	13.29	13.06	12.88	
23..	15.20	15.11	14.55	13.48	13.55	13.31	13.04	13.01	
24.....	15.25	15.04	14.62	13.42	13.72	13.21	13.13	13.15	
25.....	15.43	15.10	14.62	13.43	13.93	13.32	13.11	13.11	
26.....	15.60	15.27	14.53	13.47	14.08	13.25	13.11	13.11	
27.....	16.06	15.27	14.50	13.48	14.12	13.60	13.01	13.05	
28..	16.66	15.36	14.56	13.52	14.06	13.51	12.93	12.86	
29..	17.04	15.60	14.59	13.55	14.02	13.40	12.85	12.86	
30.....	18.03	15.55	14.61	13.58	13.96	13.32	12.74	12.58	
31..		15.51		13.55	13.75		12.65		
Mean.....	16.43	16.44	14.45	13.78	13.53	13.37	13.20	12.88	

* Denotes Mean of less than 24 hourly readings.

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DAILY MEAN Water Surface Elevations of Lake St. Peter taken at Range Light No. 2.
Elevations are above Mean Sea-level and are referred to Bench-mark, a brass plug
in north side of concrete pier. Elevation, 18.603.

Days	1915								
	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1..		17.84	14.51	13.75	12.26	12.24	11.83	11.31	11.41
2..		18.15	14.74	13.84	12.17	11.90	11.81	11.24	
3.....		18.06	14.46	13.62	12.04	11.69	11.61	11.32	
4.....		17.73	14.00	13.35	11.70	11.52	11.48	11.46	
5..		17.31	13.65	12.99	11.39	11.42	11.52	11.76	
6..		16.81	13.37	12.45	11.25	11.45	11.74	12.06	
7..		16.31	13.12	12.26	11.29	11.53	12.07	12.20	
8..		16.09	12.97	12.27	11.41	11.72	12.42	12.32	
9..		15.92	12.87	12.37	11.74	12.03	12.60	12.42	
10..		15.77	12.93	12.45	12.05	12.25	12.72	12.28	
11.....		15.66	12.95	12.46	12.14	12.33	12.74	12.23	
12.....		15.64	13.05	12.52	12.23	12.35	12.63	12.12	
13.....		15.73	13.15	12.68	12.31	12.40	12.63	11.83	
14..		15.78	13.15	12.76	12.39	12.41	12.48	11.50	
15.....		15.66	13.26	12.78	12.48	12.37	12.27	11.43	
16.....		15.53	13.25	12.84	12.45	12.17	12.02	11.73	
17.....		15.39	13.27	12.85	12.40	11.95	11.59	11.47	
18..	15.27*	15.16	13.27	12.75	12.28	11.77	11.52	11.26	
19..	15.08	14.98	13.27	12.51	12.14	11.68	11.67	11.57	
20.....	14.91	14.80	13.08	12.39	11.98	11.68	11.75	12.25	
21.....	14.77	14.57	13.02	12.36	11.93	11.82	11.90	12.14	
22.....	14.52	14.32	13.14	12.29	12.04	11.95	11.96	11.88	
23.....	14.28	14.13	13.47	12.22	12.20	11.98	11.89	11.98	
24.....	14.26	14.02	13.66	12.18	12.36	11.84	12.05	12.07	
25.....	14.47	14.09	13.63	12.16	12.63	11.98	12.05	12.09	
26.....	14.73	14.18	13.53	12.24	12.79	11.97	12.04	12.07	
27.....	15.23	14.29	13.52	12.28	12.84	12.35	11.97	12.03	
28.....	15.82	14.40	13.57	12.35	12.75	12.18	11.81	11.85	
29.....	16.28	14.68	13.60	12.39	12.72	12.06	11.70	11.76	
30.....	17.06	14.69	13.64	12.42	12.69	11.97	11.61	11.64	
31..		14.64		12.35	12.52		11.49		
Mean.....	15.13	15.56	13.44	12.62	12.18	11.97	11.99	11.84	

* Denotes Mean of less than 24 hourly readings.

CANADIAN ARCTIC EXPEDITION.

The Canadian Arctic Expedition, under the leadership of Mr. Vilhjalmur Stefansson, was fitted out in the summer of 1913. The expedition was divided into two divisions. The northern division sailed in C.G.S. *Karluk* from Victoria on the 20th July. The vessel became icebound and the party were unable to reach Banks island, where they were to have wintered.

Near Thetis island Mr. Stefansson, with D. Jenness, B. M. McConnell, and Geo. H. Wilkins, undertook a hunting trip to the mainland. During a gale which followed, the vessel was carried away and they were obliged to join the southern division wintering at Collinson point. The vessel was carried about in the ice for three months, until January, 1914, when it was crushed and sunk. In endeavouring to reach land eight members of the shipwrecked party were lost. The remaining members succeeded in reaching Wrangel island, whence, with three exceptions, they were rescued and landed at Victoria.

Upon the arrival of Stefansson at Collinson point he immediately began preparations for a trip, on foot, over the ice of Beaufort sea. Although the fate of the *Karluk* was not known to the party at Collinson point, Mr. Stefansson realized that the men in that ship, owing to ice conditions, could not be counted upon to carry out the work of the northern division. As the work of this division was to consist of the exploration of Beaufort sea to the west of Banks island and Prince Patrick island, over areas hitherto unexplored, Mr. Stefansson undertook the trip on foot, across the ice, to carry out this work.

For the purpose of utilizing the supplies therein, and to assist him during the summer of 1914, he purchased the auxiliary schooner *North Star*.

Before setting out, Mr. Stefansson gave instructions to have a ship (preferably the *North Star*) sent north to Banks island during the summer of 1914 in the event of his not returning to camp. The length of his trip over the ice was to depend entirely upon ice conditions and the possibility of establishing himself at a more northerly base.

The ice party, composed of Vilhjalmur Stefansson, Ole Andreasen, Storker Storkerson, accompanied by a supporting party, left Martin point on the 22nd March, 1914. After leaving the land-fast ice, the party experienced great difficulty from the drift of the flow which had been set in motion by a gale a few days previously. The drift, southeast, following the trend of the shore, was so fast that only two miles northing a day was averaged during the first two weeks. Mild weather added further to the difficulties of travelling. The party were further delayed by an accident to Captain Beneard, which necessitated his return to shore.

On the 7th April the party reached N. Lat. $70^{\circ} 20' 04''$, W. Long. $140^{\circ} 50' 30''$. From this point the supporting party returned to shore, leaving the ice party to pursue their trip to the north. On the 9th April the party were obliged to pass through fields of loose ice in some instances ferrying themselves across open spaces on single cakes not more than 50 feet square and two feet thick. During the night of the 9th April a terrific gale set in which caused the ice to raft considerably.

Cold weather set in after this storm and the travelling over the ice became comparatively good. Up to the 27th April, clear, calm weather prevailed. The thermometer varied from ten to twenty degrees below zero. The distance travelled ranged from fifteen to twenty-five miles a day. Thus far their direction had been due north approximately along the 140th meridian.

On the 27th April they arrived at N. Lat. $72^{\circ} 58' 28''$, W. Long. $140^{\circ} 47' 30''$. Owing to the advanced season and the scarcity of food animals on the floe it became necessary for them to make for land. They shaped a great circle course for cape Alfred, Banks island. During the first few days, owing to the character of the ice,

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they made more northing than a great circle course requires. On the 4th May they were in N. Lat. $73^{\circ} 49' 11''$, W. Long. $133^{\circ} 09'$, and on the 13th May they crossed the 74th parallel at the 130th meridian.

After the 5th May, open leads were numerous. The party were from this date on half rations, although the dogs were given full food allowance to prevent them from weakening. On the 15th May a seal was shot, and thereafter an abundance of food was obtained. On the way to land forty seals and eight bears were shot.

On the 24th May the party were stopped by a lead which was too wide to cross. They were then in N. Lat. $74^{\circ} 05' 34''$, W. Long. $128^{\circ} 01' 45''$, or about forty-five miles from the Gore islands near cape Alfred, Banks island. They were not able to cross the lead until the 5th June, when they had drifted over 40 miles west and a little south. Throughout the month of May young ice in the leads retarded progress as the raft was difficult to handle. During June the leads did not freeze over, and they were negotiated without difficulty.

Land was sighted on the 22nd June. The southerly drift encountered had carried the party south of cape Alfred. They landed at Norway island on the north coast of Banks island on the 25th June, ninety-six days after leaving Martin point.

In succeeding to reach Banks island by a trip on foot across Beaufort sea, Mr. Stefansson and his party made it possible to carry out the work as originally planned. The party carried only two weeks' provisions with them on leaving Martin point. They were, however, able to live ninety-six days and remained in good health. Mr. Stefansson thus demonstrated, during this trip, his theory that a white man can live on the resources of the northern lands and ice fields.

On this journey a portion of Beaufort sea hitherto unexplored was covered. The continental shelf extends off the Alaskan coast for a distance of 50 miles, after which the descent is very steep. Outside the continental shelf soundings taken with 1,386 meters of sounding wire gave "no bottom" until about 50 miles off the west coast of Banks island. The bottom off this coast descends gradually and in terraces.

Throughout the whole area over which the party travelled careful observations of current action were taken.

On the journey across Beaufort sea no islands were sighted. This fact, together with the results of soundings taken would indicate that no land exists for a considerable distance on either side of the area covered between Martin point and Banks island.

The summer of 1914 was spent examining the shores of Banks island in that vicinity. It was ascertained that its west coast abounds in harbours which afford excellent protection to ships. Near Norway island, what is shown on Admiralty charts as a point of land extending from the mainland was found, upon investigation, to be an island. It was named Beneard island. An investigation of Wilkins river, which empties east of Beneard island, was made. This river is the largest in northern Banks island.

Archaeological investigations carried on brought negative results; it was ascertained from the remains of old camps and other signs that no Eskimos have resided permanently in northern Banks island for at least one hundred years.

The survey work of the party during the summer of 1914 was confined to making maps of Norway and Beneard islands and Wilkins river.

The party journeyed south to Kellett, arriving on the 11th September, where they met Geo. H. Wilkins and party sent north in the *Mary Sachs* with supplies. Owing to damages sustained in the journey to Kellett, the vessel had been beached. Mr. Stefansson prepared winter quarters at Kellett and stored sufficient food supplies to maintain them during the coming winter. The party were occupied at this work until the 26th November.

On the 22nd December Mr. Stefansson, with the Eskimo Natkusiak set out on a eledge trip to De Salis bay on the southeast coast of Banks island to locate any Eskimos

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wintering there. Considerable difficulty was experienced on the journey over land owing to the uneven nature of southern Banks island, across which they travelled. De Salis bay was reached on the 3rd January, 1915. The party proceeded across Prince of Wales strait and followed the coast of Victoria island along a 5 or 6 mile stretch, a few miles north of Ramsey island, but no trace of people could be found. Owing to the advance of the winter and the necessity of making preparations for an ice trip to the north over Beaufort sea, the party were obliged to return to Kellett. They arrived at Kellett on the 27th January, where preparations for the ice trip were well under way.

Early in February, 1915, Mr. Stefansson, accompanied by Storker Storkerson, Ole Andreassen, and Charles Thomson, and with a supporting party consisting of Crawford, Natkusiak, and Wilkins, set out from Kellett, on an ice trip to explore Beaufort sea. They followed the shore of Banks island to cape Alfred. From this point the supporting party returned. Mr. Wilkins was instructed to go south to bring the schooner *North Star* to Banks island in the spring for the use of the northern division. For some days after the supporting party left them the ice party found travelling good. They soon came to a part, however, where currents keep the ice broken during the whole year. Soft snow, open leads, and rafters began to cause numerous delays. Progress was further delayed by the dogs becoming footsore.

On the 26th April in N. Lat. $75^{\circ} 44'$, W. Long. $126^{\circ} 01'$ the party met with the only accident of the journey. In passing over some thin ice the sled broke through. Although it was pulled on to solid ice before it had time to sink, the load was saturated with water. Had the sled been lost the ice trip would have ended there. The next day was spent in drying out the load.

On the 28th April they obtained their first "no bottom," sounding at a position 17 miles northwest of N. Lat. $75^{\circ} 44'$, W. Long. $126^{\circ} 01'$. In taking soundings at this point the party improvised a sounding wire by utilizing the 860 meters of good wire which they had, together with strong linen fishing line, making up a line of 1,286 meters. As the above mentioned position was about off Lands End, Mr. Stefansson decided to risk the whole line to try to get bottom. It was all paid out, but no bottom was reached. In taking up the line, however, owing to the great strain on the rather heavy fishing line, it broke and all of the line and some of the wire was lost. Thereafter the party were limited to 828 meters, which had to be the maximum depth of all their future soundings.

Up to the latitude of Lands End, currents had chiefly interfered with progress by creating open water that prevented advance, rather than by carrying the party back, though they drifted back slightly. On account of the devious character of the sled course through rough ice, the keeping of reliable reckoning was difficult.

After the 1st May the drift of the ice was about S.S.W. The current had the trend of the west coast of Prince Patrick island. Owing to the great areas of young ice encountered and the presence of open water to the westward, the party were obliged to postpone further research in that direction until the next year. They changed their course so that they travelled in a general northerly direction which brought them along the west coast of Prince Patrick island. To the west of Prince Patrick island the current was steady and uniform over large areas. By the 20th May open water forced them to seek land-fast ice. Before they could make land they were carried 50 miles south. During May the ice in the open leads did not freeze over sufficiently to permit the passage of the sled. In some instances they were obliged to negotiate the open leads by ferrying themselves across on loose cakes of ice.

Land-fast ice was finally reached some 8 miles off shore from Prince Patrick island in N. Lat. $76^{\circ} 05'$. The supply of kerosene gave out, and cooking was thenceforth done with seal blubber.

In following the coast of Prince Patrick island, north, they found it so low that it was necessary, in many places, to dig deep holes to determine if they were on land or sea.

On the 15th June they reached the islands off cape McClintock. Up to here they had carried on charting of the shore-line.

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At cape McClintock they found a cairn in which were discovered the records of F. L. McClintock. These records read as follows:—

“CYLINDER BURIED 10 FEET TRUE NORTH FROM THIS CAIRN.—None.

“TRACES.—None found.

“PARTY: All well. Have examined this shore to the south eastward for about 150 miles. The sled is now returning to the SE. preparatory to crossing to Melville island. I am about to proceed to the westward with a light sledge and two men for three marches and will then return after the main party and make the best of my way to point Nias and Dealy island.

“F. L. MCCLINTOCK,

“15th June, P.M.”

On the reverse side of the sheet there is a printed form. In the appropriate blank spaces are entries showing that the party depositing this record were from the *Intrepid*, that it was deposited on the 15th June, 1853, and it was signed again by McClintock.

The party proceeded three days to the northward, and on the morning of the third day sighted land not shown on any chart. They were at the time near the intersection of 117 W. meridian and the 78th parallel north. The visible portion of the shore appeared in a northeasterly direction from this locality. On the 19th June they arrived at the new land and journeyed in a southeasterly direction along the shore. On the 21st June they crossed a large bay which extended over 20 miles inland. This they named Wilkin's bay, after George H. Wilkins of the expedition. The accompanying chart gives approximately the position of the new land and the shore-line travelled as described by Mr. Stefansson. (See page 79.)

From observations taken from prominent points in the vicinity the land appeared hilly and extended beyond their vision. During the few days which they remained in the vicinity the atmosphere was foggy and they were unable to see far. To the westward, however, the visible portion of the land appeared low and uniformly snow-clad. To the east and northeast partly snow-free hills of some elevation could be seen, apparently at a great distance. The only thing which gave a clue to the direction of the coast to the westward was the water sky over the shore lead, which ran at first in a direction somewhat north by northwest and then turned abruptly to the west. The presumption is that the shore has a somewhat similar trend.

Animal life on the new land is plentiful, seals, caribou, foxes, lemmings, hutchins geese, gulls, owls, longspur and buntings having been seen.

It was also ascertained that a continuous chain of small islands or reefs, running west of those marked on the chart, connects Prince Patrick island with the new land. The line where the landfast ice meets the ice that is continually in motion at all seasons passes about 12 miles from the new land. This is probably the average distance of the floe from Prince Patrick island also.

Owing to the advance of the season, the party were obliged to return to Banks island for the summer work. The return journey was uneventful. They returned on the east side of Prince Patrick island. Travelling over the ice, owing to thaws, was bad. They arrived at Kellett on the 8th August, 1915.

The party were absent on this journey 171 days. They took with them very little food supplies, as their sledges were loaded with other requisites for the trip. Yet they were able to live in a healthy condition throughout, and were short of food at no time. This is the longest successful trip by foot on record in the history of Arctic exploration.

A considerable portion of Beaufort sea hitherto unvisited was covered during this trip, and the shores of Prince Patrick island were also closely investigated and sketches of the shore-line were made.

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On the 19th August the *Polar Bear*, an auxiliary schooner engaged in fishing and trading, arrived at Kellett. As Mr. Stefansson was anxious to reach the mainland and return to Kellett before the freeze up of Beaufort sea, and as the *North Star* had not arrived at Kellett, he purchased the *Polar Bear* from Captain Lane.

He proceeded to Baillie island, expecting to find the *North Star* there. As it had not yet arrived, he left instructions for it to proceed to Banks island without communicating with him. He then went to Herschel island where the *Ruby*, containing supplies for the expedition, was met. Although a good outfit was sent in that vessel, the supply of sleds and sled material was short. The services of the *Atkon*, a shallow draught power boat, belonging to the English Church Mission, were obtained to send after sledges belonging to the expedition which were up the Mackenzie river.

The *Atkon* left Herschel island on the 22nd August, and Mr. Stefansson in the *Polar Bear* left on the following day. Upon his arrival at Baillie island he purchased the *Gladiator*, a small auxiliary schooner adapted to work in the ice, to use between the winter base at Kellett and the more northerly base to be established. The presence of the *Gladiator* at Kellett would leave the members stationed there independent of the rest of the expedition. It would also afford protection to the party further north in the event of damage to the *Polar Bear*.

The *Gladiator* was sent in search of the *Atkon*, which had not been heard of since leaving Herschel island. If the *Atkon* had not reached Kittegaryuit, where the sleds were to be obtained, the *Gladiator* was to pick them up and return to Baillie island. It was then to be utilized in shipping distillate to Kellett and, in company with the *North Star*, was to proceed to the north end of Banks island, the *North Star* having arrived at Baillie island and proceeded to Banks island in accordance with instructions. According to the latest report the *North Star* sailed from Kellett on the 24th August for Prince Patrick island. If the party in her were unable to reach so northerly a point they were to establish a base in Northern Banks island.

No uneasiness was felt as to the fate of the *Atkon*, as weather conditions were ideal and a fair wind prevailed. The vessel probably met with some minor accident which necessitated landing. The members could easily join the southern division, as she probably managed to get past the Mackenzie.

Mr. Stefansson, in the *Polar Bear*, set out from Kellett for Northern Banks island on the 9th September. From there they planned to establish a base on Prince Patrick island early in the fall of 1915 from which the expeditions in the winter and early spring could be carried out.

The party in the *Polar Bear* however in endeavouring to get north on the east side of Banks island were able to proceed only as far as Princess Royal island, Prince of Wales strait, where they wintered. The *North Star* was unable to get further north than Robilliard island on the north west coast of Banks island where the party wintered. The ice trip over Beaufort sea to be undertaken in February or March of 1916 with the *North Star* as a base could not be carried out owing to the loss of some dogs and the unfit condition of others. Under the circumstances Mr. Stefansson did not wish to attempt a trip over the open sea. He, with a party, however, set out in April for the new land discovered the previous year. At the time of the latest reports received he had attained the north west coast of this land. After carefully investigating this land the party were to return south as far as Melville island in the fall of 1916, where the members of the *Polar Bear* crew who had not gone north were to store sufficient provisions to carry them through the winter. This base was to be located at Winter Harbour, Melville island. The time of the return to civilization of the whole division is not definitely known but will probably be late in the fall of 1916 or in the summer of 1917.

The health of the northern division of the expedition is reported to be excellent. With the exception of the men lost in attempting to reach land from the *Karluk* and J. Jones, engineer of the *Polar Bear*, who died of heart disease, there have been no deaths in this division.

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SOUTHERN DIVISION.

The southern division of the expedition sailed from Victoria in C.G.S's. *Alaska* and *Mary Sachs* on the 19th and 20th July, 1913, respectively. Owing to ice conditions the party were unable to reach Coronation gulf, where their winter quarters should have been established, and they were obliged to winter at Collinson point, Alaska. As previously reported, the southern party were joined at Collinson point by Mr. Stefansson. Throughout the winter and spring of 1914 the scientific members carried out investigations in that vicinity.

Early in June, 1914, Geo. H. Wilkins was sent to Demarkation point to take charge of the *North Star* which had been purchased by Mr. Stefansson.

On the 7th July the *Alaska* and *Mary Sachs* were free from the ice. The party were delayed until the 25th July on account of ice holding close to the shore outside the harbour. On the 25th July they left Collinson point. They reached Demarkation point on the 4th August, where they took up the supplies purchased by Mr. Stefansson. They arrived at Herschel island on the 5th August, where they met Mr. Wilkins with the *North Star*.

On the 11th August Geo. H. Wilkins, in charge of a party in the *Mary Sachs* sailed for Banks island. This party purposed to locate the Stefansson party if possible. Proceedings after their arrival at Kellett, Banks island, have been reported in connection with the northern division.

The members of the southern division left Herschel island on the 17th August, and Bailey island on the 22nd August. On the 24th August the party came to a harbour near Chantry island, which is unmarked on the charts. This harbour is situated about 15 miles east of Cockburn point, on the mainland, and on the south side of Dolphin and Union strait about midway between cape Bexley and cape Krusenstern, directly south of Liston and Sutton islands. The harbour is practically land-locked, with an average depth of four fathoms. The division made their headquarters for the coming winter at this point and named it Bernard harbour.

During the summer the sea was practically clear of ice east of Herschel island, while west of that place the ice remained closely packed.

On the 6th September, Dr. Anderson, accompanied by Messrs. Sweeney, Castel, Blue, Sullivan, and two Eskimos, set out in C.G.S. *Alaska* from the new base for Herschel island for supplies. They arrived at Herschel island on the 11th September and loaded the required supplies. On the return voyage the vessel was frozen in at Bailey island.

Leaving Mr. Sweeney and Engineer Blue in charge of the vessel, Dr. Anderson, with the remaining members of the party, set out on foot along the coast on the 20th November to join their division at Bernard harbour. They arrived at the base on the 25th December.

During the winter Dr. Anderson, with Aarnaut Castel, attempted a trip to fort Noman to despatch mail. Owing to rough ice on the Coppermine river, and deep snow on the Deas river, they were unable to carry out the journey. They returned to the base, arriving on the 1st April, where they found that the winter's work had been carried on in a satisfactory manner.

John R. Cox and D. Jenness surveyed the coast in detail from the winter base east along the north side of the strait to cape Krusenstern and as far as point Lockyer.

D. Jenness during the winter succeeded in bringing to light much information in connection with the hitherto little known groups of Eskimos in this region. He found that the groups are not so definite as was formerly supposed, but that they are pretty thoroughly mixed. He took gramophone records of Eskimo songs and spoken words and he succeeded in learning many of the different dialects spoken by the natives. He carried out all the trading with the Eskimos, and collected large numbers of specimens of their tools, weapons, clothing, etc. In the early spring he made arrangements

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to go to Victoria island to study the ethnology of the natives there. He set out for Victoria island on the 18th April, where his investigations should add materially to the already exhaustive information compiled. He was to return to the base as soon as the sea would freeze in Dolphin and Union strait in the fall of 1915.

Kenneth G. Chipman and Dr. J. J. O'Neill started on the western survey from Bernard harbour on the 17th March. It had been decided that Mr. Chipman should work with Dr. O'Neill in covering this region, as they had already made a preliminary reconnaissance by sled as far west as Keat's point in November and December, 1914, and were familiar with the features of the problems to be encountered. They went west as far as the southwest portion of Darnley bay in order to connect with the previous surveys of the cape Parry peninsula. From this point the survey was carried eastward during April, the season being much further advanced than it was farther east during the same period. As there are no rock exposures near the coast on the south side of Darnley bay, Dr. O'Neill was able to remain on the east side of the bay to carry on geological investigations. One of the largest unnamed rivers flowing into Darnley bay was ascended for some distance. Considerable assistance was obtained from the friendly aid of Capt. C. Klengenbergh, an ex-whaler and trapper, and from a family of Alaskan Eskimos, who were temporarily located on the east side of the bay. Captain Klengenbergh's son acted as interpreter for the party.

The rock exposures around the coast were found to be quite continuous from the south of cape Lyon around to the east of Dewitt Clinton point, and Dr. O'Neill was able to follow them up and made a practically continuous section, including one or two important contacts on the diabase with the prevailing dolomitic and conglomerate rocks of that section of the coast. A good series of geological specimens was collected by Dr. O'Neill at all points touched, including certain fossils from the superficial formations around Darnley bay. Dr. Anderson set out from Bernard harbour on the 21st April and met Messrs. Chipman and O'Neill coming east near Deas Thompson point on Amunsden gulf. The Eskimos, Ikey and Palaiyak, who were with the party, were sent on to Bailey island with the mail, and to help on the *Alaska*. Dr. Anderson returned to the eastward with the survey party.

Mr. Chipman reports that the whole country surveyed is evidently a portion of the coastal plain described by Tyrrel (Tyrrel, J. B., report on the Doobaunt, Kazen and Ferguson rivers, volume 9, page 158), which west of Hudson bay reaches an elevation of 500 to 600 feet, and varies in width from 75 to 300 miles.

Inland on the east side of Darnley bay beach gravels and terraces were found above 500 feet, and everywhere east of that point the country for some distance from the coast is of the same type. From Darnley bay to the east of Deas Thompson point there are a number of high points but no definite system of range is apparent. The highest of these points are near the Croker and Inman rivers. The coast has a well-defined shore-line of rock or boulders and gravel. None of the rivers flowing to the coast east of Darnley bay extend any great distance inland, for their valleys are small, and both valleys and beds indicate a very heavy run-off in a short time. The Croker is the largest river, with its delta built out a short distance, and occupies a triangular valley some 4 miles wide at the coast, and extending inland for 3 or 4 miles. The river spreads out over its delta, and none of its channels are very definite. The beds of this and other rivers are composed of heavy boulders, and the quick run-off is further indicated by the continuous sand bars built across their mouths when the water is low in summer and fall. At the back of Darnley bay two fairly large rivers flow to the coast.

The survey of this entire stretch of coast line was completed northeast to the base station to connect with the survey made by Mr. John R. Cox. The coast line as traversed from cape Lyon east is seen to be somewhat straighter than the charts show.

Messrs. Chipman, O'Neill, and Anderson reached the station at Bernard harbour on the 24th May. Throughout the spring unusually mild and clear weather prevailed,

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which enabled the different parties to carry out their work to the best possible advantage. John R. Cox, with Jas. Sullivan as camp assistant, on the 16th April, took up the survey which he had left off at point Lockyer, Coronation gulf. He continued to survey around Basil Hall bay, cape Hearne, cape Kendall, up into Back's inlet, and up the Rae river. He ascended and surveyed the Rae river for about 70 miles until it forked into two small creeks. Mr. Cox found rather large willows at frequent intervals on the Rae river after getting some way from the coast, but no spruce or other timber was found. After reaching the head of the Rae river, he made a six-day portage across country with his sled, striking the Arctic coast on the south side of Stapylton bay. He also surveyed a section of the coast from Young point (the western end of Stapylton bay) east of the home station, reaching Bernard harbour on the 25th May. He found that South bay (southwest of Cape Bexley) is somewhat deeper, and Stapylton bay is not so deep as the existing charts indicate. Maps covering the results of these surveys are in course of preparation.

Mr. Fritz Johansen, marine biologist, botanist, and entomologist, carried on extensive work throughout the year. He collected and preserved considerable marine and fresh-water biological material from the harbour and from the neighbouring lakes, ponds, and streams. A practically complete collection of the local flora has been preserved, and the large collections made at Collinson point, Alaska, and Herschel island, Yukon territory, have been arranged. A good many interesting entomological specimens were obtained, and he also succeeded in rearing some larvæ collected the previous season at Collinson point, and working out some hitherto unknown points in the life history of the various forms of Arctic insects. He obtained interesting data in connection with the various insects at the northern limit of spruce trees during a short trip up the Coppermine river, in February. About 500 specimens of mammals and birds, besides a number of sets of eggs, with nests, were collected. Photographs of the nests of Arctic birds were also taken.

On the 21st May, 1915, George H. Wilkins, James R. Crawford, and an Eskimo, arrived at Bernard harbour from Kellett, the base of the northern division; they came on foot from Kellett, making the journey across the southern end of Banks island, Prince of Wales strait, Prince Albert Sound and Dolphin and Union strait, in twenty-five days.

Mr. Stefansson had sent this party in charge of Wilkins to the southern base to bring the *North Star* to Kellett for the use of the northern division as soon as possible after the opening of navigation.

Mr. Wilkins brought a cinematograph outfit with him from the northern party base and exposed about 2,000 feet of film, principally of views of the local Eskimos. He has also made a very good series of portrait studies of the Eskimos, men, women, and children, for Mr. Jenness' ethnographical work, and has taken photographs of growing plants, flowers, insects, birds, mammals, etc., which are of great scientific as well as of artistic value.

During the summer of 1915 it was proposed to carry on the survey of the coast east of Bernard harbour as far as Cape Barrow. Mr. J. R. Cox and Dr. J. J. O'Neill set out from Bernard harbour to the eastward on the 9th June. The party were to proceed by sled, if possible, to the Tree river or the Unialik, or one of the other small rivers on the south side of Coronation gulf east of the Coppermine river. During the early summer they were to carry on geological work up some of these rivers as far as they would judge desirable and then eastward along the coast as far as Cape Barrow on the western extremity of Bathurst inlet. At Cape Barrow the circumstances of the season and the condition of the party and boats were to determine the extent of the survey which would be made of Bathurst inlet during the latter part of the summer. They desired to finish as much as possible of the eastern end of the assigned territory during the summer, leaving the region nearer Bernard harbour for the early fall or coming spring when the unfinished ends could be worked to better advantage from the

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It was also essential that the party should have a boat to assist in carrying out their work. As the *North Star* was the only vessel available at the southern base, the *Alaska* being at Bailey island bound for Herschel island before coming to Bernard harbour, it was necessary to use it to carry out the work in connection with the eastern survey before turning it over to Mr. Wilkins to be taken to Banks island. The *North Star* was loaded for her trip east before the break up of the ice, so that she would be able to proceed immediately upon the opening of navigation.



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The summer of 1915 in this area was, however, very cold, and the ice melted slowly. Bernard harbour was free of ice from the 20th July, but Dolphin and Union strait was blocked. A steady strong northwest wind, practically a gale, for three or four days kept drifting the ice down into and blocking up the strait until the 1st August.

On the 9th August the vessel was worked out through the ice east of Chantry island and then north of Lambert island, thence around cape Krusenstern.

On the 10th August, ice, lightly massed, was found on the south shore from Chantry island to the south side of Lambert island and to cape Krusenstern. After passing cape Krusenstern very little ice was encountered and Coronation gulf was entirely free to the eastward.

The party in the *North Star* reached Epworth point (Tree river) and found that Dr. O'Neill and J. R. Cox had worked in that region from early in June until they got their boat out in Coronation gulf on the 30th July, and then had gone east to cape Barrow. Upon arrival at cape Barrow a beacon was found stating that the survey party had reached that point on the 2nd August. Caches of provisions and gasoline were put down at Epworth point and at cape Barrow. The *North Star* was then handed over to Mr. Wilkins to be taken to Banks island, and the party continued the survey further eastward, using the gasoline launch and a skin boat. The *North Star* proceeded to Bailey island, where instructions had been left by Mr. Stefansson to proceed immediately to Banks island and thence as far north as possible.

Messrs. K. G. Chipman, J. R. Cox, J. J. O'Neill, and Dr. R. M. Anderson, composing the eastern survey party, carried on survey work along the coast in the vicinity of cape Barrow throughout the summer. They returned to the base at Bernard harbour in the fall where the different surveys were completed to the base station.

The survey of the mainland coast line in detail was completed from the west side of Darnley bay to a point well down into Bathurst inlet including a large number of the islands in the Coronation Gulf region, as well as large portions of several of the hitherto unexplored rivers of the region, including one of the Darnley Bay Rivers, the Croker river flowing into Amunsden gulf, and the Rae river and the Tree river flowing into Coronation gulf. The geological features of the region have been investigated and the relation of the different formations studied in detail at the most important points of contact.

The geological investigation included the detailed mapping and estimation of the available copper-bearing rock in a great new area hitherto little known in the Bathurst inlet region. Dr. O'Neil reports vast quantities of copper-bearing rock in which he saw native copper in this region.

Mr. D. Jenness, ethnologist, made a careful study of the language, manners, customs, etc., of the natives of Victoria island as well as a collection of specimens of their tools and dishes, and has taken gramophone records of their dance songs and shamanistic performances.

The marine biologist, Mr. Frits Johansen, has also made extensive collections of Arctic insects and other species of the little known animals of the north.

The southern division should complete the survey of the territory allotted to them during the summer of 1916.

With the exception of engineer Blue, who died of scurvy during the winter of 1913-14, the health of the southern division of the expedition is reported as very good.

The expedition, both northern and southern divisions, are to return from the north in the fall of 1916 or early in 1917.

Very valuable scientific work has been carried on by both the northern and southern divisions, and much useful information, both as to the nature of the areas investigated and the inhabitants of the Far North, has been obtained.

Complete reports covering the whole period from the departure until the return of the expedition will be prepared upon the arrival of the members from the north.

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LIFE-SAVING SERVICE.

OTTAWA, 1st April, 1916.

The Deputy Minister,
Department of the Naval Service,
Ottawa.

SIR,—I have the honour to report below with reference to the Life-saving Service of Canada for the fiscal year ending 31st March, 1916.

Every year now the work of these stations seems to be gradually lessening and the life-boats are used more for the salvage of property in most cases than for saving life.

The station at Kincardine, Ont., has been done away with, as the buildings were badly in need of repair and the services rendered did not seem sufficient to justify further expenditures.

Frequent inspections of the various stations have taken place during the year, and the regular drills have been carried out.

NOVA SCOTIA.

Bay View.—Permanent crew. Some fourteen fishing boats have been towed to safety; the life-boat also succeeded in towing the schooner *Cora and Gentie* off the rocks west of Digby gut, after six hours' work, on the 10th February, 1916.

Herring Cove.—Volunteer crew. This crew succeeded in saving part of the cargo of the ss. *Perry*, which ran ashore on the 7th June, 1915, in Chebucto harbour, and became a total loss. They were also of considerable assistance in running lines, standing by, etc., for almost the whole four days while the oil tank s.s. *Potomac* was ashore at Willis' point in February, 1916.

Seal Island.—Subsidized volunteer crew. Went to the assistance of the fishing schooner *Little Ruth*, grounded on the southern side of the island in May, 1915, and towed her off. Landed a considerable amount of lumber from the abandoned schooner *Lewis K. Cottingham*.

Whitehead.—The volunteer crew at this station succeeded in towing the schooner *James U. Thomas* off when it was stranded on the eastern side of the harbour in a dangerous position in November, 1915.

NEW BRUNSWICK.

Cape Tormentine.—This volunteer crew assisted in refloating a steam trawler which grounded on Jourmain Island reef on the 2nd August, 1915.

Richibucto.—Permanent crew. Various disabled fishing boats received assistance from this station; also the barkentine *Ocean Ranger* and the schooner *Nora Zembla* were refloated. The schooners *Beaver* and *Seedonis* were rendered assistance.

ONTARIO.

Point Pelee.—Permanent crew.—Stood by for two days, when the schooner *Phillip Minch* grounded in a fog on the southeast shoal, on 4th May, 1915. In December the *Victory* grounded on the east side of Point Pelee; the life-saving crew procured a tug and she was towed off after two days. A boy was also saved from drowning in July by one of the members of this crew.

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Toronto.—Permanent crew. On the 3rd August, 1915, in the worst storm of the season the steamer *Alexandria* went ashore; the life-saving crew took off four members of the crew, including the captain, the others having left the ship previously. This station, which is very up-to-date and well equipped, is kept busy during the season of navigation in watching the various pleasure boats which are so numerous in that vicinity. Last year 107 launches, yachts, sail-boats, etc., grounded, capsized or otherwise disabled, were assisted, besides eleven hydroplanes, and nineteen injured persons; twenty-one drowned persons were also recovered, and the pulmotor was used thirteen times.

BRITISH COLUMBIA.

Banfield.—Permanent crew. The gasoline launch *Sarita*, with four people on board, was taken off a reef near cape Beale and towed to safety, on the 28th June, 1915. In September the vessel *Dexter* floated on a reef at Blizzard island and the crew succeeded in taking her off and towing her to safety. Several launches also received assistance.

Clayoquot.—Permanent crew. The Anglican Mission launch went ashore on the rocks near Tofino on 16th November; the lifeboat took two men off, and at high water next day succeeded in floating the vessel. On 25th November crew was called to the assistance of the *Carelmapu* and succeeded in saving five men; eighteen persons were lost.

Ucluelet.—Various launches, etc., have received assistance from the permanent crew at Ucluelet, which crew was also called out to the *Carelmapu*. The coxswain reports the work on the station as being mainly preventive, the crew constantly rendering assistance to vessels before the danger has become too great.

The attached statement shows the number of stations in each province, with the number of their crew, name of coxswain, description of boat, and date of establishment.

I have the honour to be, sir,
Your obedient servant,
C. E. KINGSMILL, *Vice-Admiral*,
Director of the Naval Service.

LIFE-SAVING STATIONS OF CANADA.

No.	Stations.	Estab- lished.	Coxswain.	Crew.	Description of Boat.
<i>New Brunswick.</i>					
1	Little Wood Is. (P)	1910	Harry Harvey...	8	Beebe-McLellan twin screw motor boat; schooner chartered for winter months.
2	Richibucto (P.N.).....	1907	Thos. Legoof	7	Race Point surf-boat 24 ft. long.
3	Point Escuminac.....	1908	E. F. Flieger.....	7	Beebe-McLellan self bailing.
4	Cape Tormentine..	1912	I. Allen.....	7	" " "

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LIFE-SAVING STATIONS OF CANADA—*Concluded.*

No.	Stations.	Estab- lished.	Coxswain.	Crew.	Description of Boat.
<i>Nova Scotia.</i>					
5	Baker's Cove.....	1886	R. L. Baker.....	7	Dobbin's pattern self-righting, 28 ft. long.
6	Blanche....	1889	Edgar Swaine....	7	Beebe-McLellan surf-boat, self- bailing, 25 ft. long.
7	Clark's Harbour.	1900	Byron Swim.....	7	Beebe-McLellan, self-bailing, 25 ft. long low ends.
8	Canso.....	....	J. J. Barrigan..	7	Dobbin's pattern, surf-boat, self-bailing, 25 ft. long.
9	Devil's Island.....	1885	B. H. Henneberry.....	7	Beebe-McLellan surf-boat, self- bailing, 25 ft. long.
10	Duncan Cove.....	1886	J. W. Holland	7	" " "
11	Herring Cove....	1885	Edw. V. Dempsey..	7	Dobbin's pattern self righting and bailing, 25 ft. long.
12	Pictou Island.....	1889	Duncan McCallum...	7	" " "
13	Port Mouton.....	1889	Walter Cook....	7	Beebe-McLellan surf-boat, self- bailing, 25 ft. long.
14	Scattarie.....	1885	Jas. Nearing.....	7	Beebe-McLellan boat on East side.
15	Seal Island, (P).....	1880	Smith G. Penney..	7	Beebe-McLellan boat on West side.
16	Whitehead.....	1890	John Phalen.....	7	Dobbin's pattern surf-boat, self-bailing, 25 ft.-long.
17	Cheticamp, (P.N.).....	1911	L. J. AuCoin.....	7	Beebe-McLellan, twin screw motor boat.
18	Bay View, Digby, (P.N.).....	1911	J. W. Hayden.....	7	36 ft. self-bailing, self-righting power boat.
19	Westport, Brier Is.....	....	Ralph Welch.....	-	Subsidized motor boat.
<i>P. E. Island.</i>					
20	Priest Pond.....	1909	Chas. Campbell.....	12	Board of Trade rocket appa- ratus.
21	Charlottetown.....	1907	E. White.....	6	Beebe-McLellan self bailing.
22	Souris.....	1907	Pius Cheverie.....	7	" " "
23	Cascumpeque..	....	Joshua Hutt.....	8	" " "
24	Alberton.....	1907	S. Gallant.....	12	Board of Trade rocket appa- ratus.
<i>British Columbia.</i>					
25	Banfield, (P).....	{1909} {1907}	Geo. Murray.....	11	Self-righting, self-bailing, 36 ft. power boat.
26	Ucluelet, (P).....	1908	F. Tyler (act.)...	9	Doherty's Improved Beebe- McLellan, 25 ft. long.
27	Clayoquot, (P).....	1908	J. McLeod.....	8	" " "
<i>Ontario. Great Lakes.</i>					
28	Cobourg.....	1882	D. Rooney.....	8	Dobbin's pattern self-righting and bailing.
29	Collingwood....	1885	G. F. Watts.....	7	Beebe-McLellan self-bailing surf-boat.
30	Goderich.....	1886	Malc. McDonald...	7	Surf-boat.
31	Long Point, (P.N.).....	1902	Jas. Smith.....	9	"
32	Point Pelec, (P.N.)....	1900	L. Wilkinson.....	7	"
33	Port Hope.....	1889	John McMahon.....	7	Dobbin's pattern, self-righting and bailing.
34	Port Stanley.....	1885	W. Brown.....	7	Beebe-McLellan surf-boat, self- bailing, 25 ft. long.
35	Toronto, (P.N.).....	1883	W. F. Chapman.....	14	Two motor launches.
36	Consecon	1898	R. Bedford.....	7	Dobbin's pattern, self-righting and bailing.
37	Southampton.....	1907	Hector McLeod.....	7	Beebe-McLellan, surf-boat, self self-bailing.

NOTE.—Stations marked "P" have permanent crews, always on duty; those marked "P.N." have crews always on duty during the season of navigation. The other stations simply have volunteer crews, which drill twice a month and are called out on the occurrence of a wreck.

RADIOTELEGRAPH SERVICE.

The Deputy Minister,
Department of the Naval Service,
Ottawa.

SIR,—I have the honour to present herewith the annual report of the Radiotelegraph Branch for the fiscal year ending the 31st March, 1916.

The total number of stations in operation in the Dominion and on ships registered therein is as follows:—

Government commercial stations.. . . .	1
Coast stations.. . . .	42
Government ship stations.. . . .	24
Licensed ship stations.. . . .	64
Public commercial stations.. . . .	3
Private commercial stations.. . . .	4
Radio telegraph training schools.. . . .	2
Licensed experimental stations.. . . .	2
Total.. . . .	142

The following list shows the location of the land and coast stations in Canada, their range, call signals, owners, and by whom they are operated:—

COAST STATIONS for Communication with Ships.
EAST COAST.

Name.	Where situated.	Owned by.	Operated by.	Range in nautical miles.	Call Signal.
Belle Isle, Nfld.	Belle Isle Straits.....	Dominion..... Government.	Marconi Wire- less Tel. Co. of Canada.	250	VCM
Pt. Amour, Nfld.	" " "	" "	"	150	VCL
Pt. Riche, Nfld.....	Gulf of St. Lawrence...	"	"	250	VCH
Harrington, P.Q.....	" "	"	"	150	VCJ
Heath Pt., P.Q.....	Gulf of St. Lawrence... (Anticosti Isld.)	"	"	250	VCI
Cape Ray, Nfld	Cabot Straits.....	"	"	350	VCR
Cape Race, Nfld..	North Atlantic.....	"	"	400	VCE
Grindstone Island, P.Q.....	Gulf of St. Lawrence (Magdalen Isld.).	"	"	200	VCN
Fame Pt., P.Q..	Gulf of St. Lawrence....	"	"	250	VCG
Clarke City, P.Q.....	"	"	"	250	VCK
Father Pt., P.Q..	River St. Lawrence.....	"	"	250	VCF
Grosse Isle, P.Q.	"	"	"	100	VCD
Quebec, P.Q.....	"	"	"	150	VCC
Three Rivers, P.Q.....	"	"	"	150	VCB
Montreal, P.Q.....	"	"	"	200	VCA
Cape Sable, N.S.	North Atlantic.....	"	"	250	VCU
Partridge Isld., St. John, N.B.	Entrance St. John Harbour, N.B.	"	"	250	VCV
Cape Bear, P.E.I	Northumberland Strait.	"	"	150	VCP
Camperdown, N.S.....	Entrance to Halifax Harbour.	"	"	250	VCS
Sable Island, N.S.	North Atlantic.....	"	"	300	VCT
Halifax, N.S.....	Halifax Dockyard.....	"	Department of the Naval Service.	100	VAA
Pictou, N.S.....	Northumberland Strait.	Marconi Wire- less Tel. Co. of Canada.	Marconi Wire- less Tel. Co. of Canada.	100	VCQ
North Sydney, C.B.....	North Sydney, C.B..	"	"	100	VCO

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COAST STATIONS for Communication with Ships—Concluded.

GREAT LAKES.

Name.	Where Situated.	Owned by.	Operated by.	Range in nautical miles.	Call Signal.
Port Arthur, Ont.....	Port Arthur, Ont.....	Dominion Government.	Marconi Wire- less Tel. Co. of Canada.	350	VBA
Sault Ste. Marie, Ont.....	Sault Ste. Ont.....	"	"	350	VBB
Tobermory, Ont.....	Entrance Georgian Bay.	"	"	350	VBD
Midland, Ont.....	Georgian Bay.....	"	"	350	VBC
Point Edward, Ont.....	Lake Huron.....	"	"	350	VBE
Port Burwell, Ont.....	Lake Erie.....	"	"	350	VBF
Toronto, Ont.....	Toronto Island, Ont...	"	"	350	VBG
Kingston, Ont.....	Barriefield Common....	"	"	350	VBH

WEST COAST.

Gonzales Hill, B.C. (Victoria).	Victoria, B.C.....	Dominion Government.	Department of the Naval Service.	250	VAK
Pt. Grey, B.C. (Vancouver).	Entrance Vancouver Harbour.	"	"	150	VAB
Cape Lazo, B.C.....	Strait Georgia, near Comox, B.C.	"	"	350	VAC
Pachena Pt., B.C.....	West Coast Vancouver Isld.	"	"	500	VAD
Estevan Pt., B.C.....	" "	"	"	500	VAE
Triangle Isld., B.C.....	South of Hecate Str.....	"	"	450	VAG
Ikeda Head, B.C.....	South of Moresby Island, Q.C.I.	"	"	250	VAI
Dead Tree Pt., B.C.....	South of Graham Isld., Q.C.I.	"	"	200	VAH
Digby Island, B.C., Prince Rupert.	Digby Isld., Entrance Prince Rupert Har.	"	"	250	VAJ
Alert Bay, B.C.....	Cormorant Isld., B.C...	"	"	350	VAF

HUDSON BAY.

Port Nelson.....	Hudson Bay.....	Dominion Government.	Department of the Naval Service.	750	VBN
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LAND STATIONS.

Le Pas, Man..	For communication with Port Nelson only.	Dominion Government.	Department of the Naval Service.	750	VBM
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LICENSED Commercial Stations.

Name.	Where Situated.	Owned by.	Operated by.	Range in nautical miles.	Signal. Call
<i>Public Commercial.</i>					
Glace Bay, C.B.	Near Glace Bay, C.B.	Marconi Wireless Tel. Co. of Can., Ltd.	Owners.....	3,000	G.B.
Louisburg, C.B. Newcastle, N.B.	Cape Breton New Brunswick..	Universal Radio Synd.	"	Reception only 2,500	CL
<i>Private Commercial.</i>					
Ocean Falls, B.C.	Ocean Falls, B.C.	Ocean Falls Co.	Owners.....	150	CD.
Powell River, B.C.	Powell River, B.C.....	Powell River Co.	"	30	CH
Glengarry, Alta.....	Glengarry Sub. Calgary.	Alberta Oil Co.	"	50	CJ
Section 11, Township 23	Sec. 11, Township 23....	"	"	50	CK

LICENSED Experimental Stations.

Name.	Where Situated.	Owned by.	Call Signal.
Marconi Test Room..	Rodney St., Montreal..	Marconi Wireless Telegraph Co. of Canada, Ltd.	XWA
79th Overseas Btln..	Brandon, Man....	79th Overseas Btln.....	XWB

RADIOTELEGRAPH Training Schools.

Name.	Where Situated.	Call Signal.
Dominion Telegraph & Wireless Institute.....	Vancouver, B.C.....	Licensed for reception only.
Columbian College of Wireless.....	Victoria, B.C.....	

AMATEUR Radiotelegraph Stations.

All amateur stations were closed down at the outbreak of hostilities.

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LICENSED SHIP STATIONS.

The following list shows the vessels of Canadian register which are equipped with radiotelegraph apparatus, their call signal and by whom they are owned and operated:—

Name of Ship.	Port of Registry.	Name of Owners.	Name of Company operating the Station.	Call Signal.
SS. Assiniboia....	Montreal, P.Q....	Can. Pacific Railway.	Marconi Wireless Tel. Co. of Can.....	VGI
" Alberta.....	"	"	"	VFQ
" Athabaska.....	"	"	"	VGG
" Manitoba.....	"	"	"	VGH
" Keewatin.....	"	"	"	VGC
" Boston.....	Yarmouth, N.S....	"	"	VFS
" Hamonic.....	Collingwood, Ont....	Northern Nav. Co....	"	VGD
" Huronic.....	"	"	"	VGE
" Province.....	Port Arthur, Ont....	Great Lakes Towing and Wrecking Company.....	"	VFR
" Empire.....	"	"	"	VFP
" Salvor	Victoria, B.C.....	B.C. Salvage Co.....	Owners.....	VFV
" Prince Albert.....	Prince Rupert, B.C....	Grand Trunk Pac. Ry.	"	VFL
" Prince John.....	"	"	"	VFM
" Florence.....	Toronto, Ont.....	T. Eaton.....	"	VFT
" Princesse Beatrice...	Victoria, B.C.....	Can. Pacific Railway.	M. W. T. Co. of C	VFC
" Princess Charlotte...	"	"	"	VFE
" Princess May.....	Vancouver, B.C.....	"	"	VFH
" Princess Royal.....	Victoria, B.C.....	"	"	VFG
" Tees.....	"	"	"	VFK
" Camosun.....	Vancouver, B.C.....	Union Steamship Co.	Owners.....	VFZ
" Princess Adelaide...	Victoria, B.C....	Can. Pacific Railway.	Marconi Wireless Tel. Co. of Canada.....	VFA
" Princess Mary....	"	"	"	VFB
" Princess Alice.....	"	"	"	VFD
" Princess Ena.....	"	"	"	VEJ
" Princess Sophia.....	"	"	"	VFI
" Saronic.....	Sarnia, Ont....	Northern Nav. Co..	"	VGF
" Lord Strathcona.....	Quebec, P.Q....	Quebec Salvage Co....	"	VFX
" A. W. Perry.....	Halifax, N.S....	Plant Line.....	"	VFW
" Royal Edward.....	Toronto, Ont.....	Canadian Northern SS.	"	VGB
" Royal George.....	"	"	"	VGA
" St. Ignace.....	Port Arthur, Ont....	Great Lakes Towing and Wrecking Co....	"	VGL
" Chelohsin.....	Vancouver, B.C....	Union Steamship Co..	Owners.....	VGN
" Morwenna. .	Montreal, P.Q....	The N.Y. Nfld. Halifax Shipping Co.	Marconi Wireless Tel. Co. of Canada.....	VFN
" Prince Arthur.....	Yarmouth, N.S....	Boston and Yarmouth SS. Co.	"	VGJ
" Prince George.....	"	"	"	VGK
" Halifax.....	Halifax, N.S....	C. A. Plant SS. Co..	"	VGP
" Douglas H. Thomas.	Sydney, C.B.....	Dom. Coal Co.....	"	VGR
" Princess Maquinna....	Victoria, B.C.....	Can. Pacific Railway.	"	VGT
Car Ferry "Ontario No.1"	Montreal, P.Q....	Ont. Car Ferry Co....	Owners.....	VGU
SS. Naronic.....	Port Arthur, Ont....	Northern Nav. Co....	Marconi Wireless Tel. Co. of Canada.....	VGW
" Seal.....	Windsor, N.S....	Halifax Trading and Sealing Co.	"	VGX
" Deliverance.....	Liverpool, N.S.....	Southern Salvage Co..	M. W. T. Co.....	VFO
" Bessie Dollar.....	Victoria, B.C.....	Dollar SS. Lines.....	Owners.....	VFF
" Venture.....	Vancouver, B.C.....	Union SS. Co.....	"	VGX
" Yarmouth.....	Yarmouth, N.S....	C.P.R.....	M. W. T. Co.....	VGZ
" Princess Patricia.	Victoria, B.C....	"	Owners.....	VEA
SS. Dalhousie City....	Toronto, Ont.....	N. St. C. & T. N. Co.	M. W. T. Co.....	VEB
" Corona.....	"	C. SS. Lines.....	"	VEC
" Kingston.....	"	"	"	VED
" Toronto.....	"	"	"	VEE
" Hazel Dollar.....	Victoria, B.C....	Dollar SS. Lines..	"	VEH
" Chippewa.....	Toronto, Ont....	"	"	

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LICENSED SHIP STATIONS—*Concluded.*

Name of Ship.	Port of Registry.	Name of Owners.	Name of Company operating the Station.	Call Signal.
SS. Garden City.....	Toronto, Ont.....	N. St. C. & T. N. Co.	M. W. T. Co.	VEI
" Chicora.....	Halifax, N.S.	C. S. S. Lines	"	VEJ
" Macassar ..	Hamilton, Ont...	"	"	VEK
" Cayuga.....	Toronto, Ont.....	"	"	VEL
" Majestic.....	Collingwood, Ont	"	"	VEM
" Cascapedia.....	Quebec, P.Q.....	"	"	VEO
" Desola.....	Montreal, P.Q.....	Atlantic Fruit Co..	"	VEP
Tug "Harrison"	Owen Sound, Ont.....	J. Harrison & Sons....	"	VFY
Car Ferry "Ontario No. 2"	Montreal, P.Q.....	Ont. Car Ferry Co....	Owners.....	VER
SS. Imperoyal.....	Sarnia, Ont.....	Imperial Oil Co.....	M. W. T. Co..	VGM
" Armonia.....	Montreal, P.Q...	R. Lawrence Smith...	"	VES
" Turret Crown.....	Newcastle, G.B.....	Coastwise S.S. & Barge Co..	Owners.....	ZH

GOVERNMENT STEAMERS EQUIPPED WITH RADIOTELEGRAPH INSTALLATIONS.
OPERATED by the Department of the Naval Service.

Name.	Range.	Call Signal.
H.M.C.S. Niobe.....	400 miles	VDA
" Rainbow..	250 "	VDB
C. G. S. Canada.....	150 "	VDC
" Acadia ..	200 "	VDT
" Malaspina..	200 "	VDU
" Galiano	200 "	VDV

OPERATED by the Department of Marine and Fisheries.

Name.	Range.	Call Signal.
C. G. S. Stanley.....	150 miles.	VDE
" Lady Laurier	150 "	VDF
" Aberdeen ..	100 "	VDG
" Druid ..	100 "	VDH
" Montcalm	150 "	VDJ
" Lady Grey.....	100 "	VDL
" Quadra.....	100 "	VDM
" Estevan.	200 "	VDN
" Dollard.....	150 "	VDO
" Newington.....	100 "	VDP
" Lurcher Lightship.....	100 "	VDR
" Semcoe..	100 "	VDS
" Aranmore.....	200 "	VDQ
" Prince Edward Island.....	100 "	VBY

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OPERATED by the Department of Railways and Canals.

Name.	Range.	Call Signal.
C. G. S. <i>Durley Chine</i>	200 miles.	VDQ
" <i>Sheba</i>	200 "	VDZ

OPERATED by the Post Office Department.

Name.	Range.	Call Signal.
C. G. S. <i>Lady Evelyn</i>	100 miles.	VDX

OPERATED by the Customs Department.

Name.	Range.	Call Signal.
C. G. S. <i>Margaret</i>	200 miles.	VDW

OPERATION OF THE COAST STATION SERVICES.

The following stations on the East Coast previously operated by the Marconi Wireless Telegraph Company of Canada were taken over from that company, and are now operated by the Department of the Naval Service:—

Camperdown, N.S., on May 1, 1915
 North Sydney, N.S., on August 1, 1915.
 Point Riche, Newfoundland, September 1, 1915.
 Sable Island, N.S., January 1, 1916.

The amount of business handled by the East Coast system shows a decrease from last year's business, amounting to 14,651 messages, containing 332,492 words.

The Great Lakes system (operated by the Marconi Wireless Telegraph Company of Canada, Limited, under contract) shows a decrease of 2,168 messages containing 67,139 words.

The West Coast system (operated directly by this Department) shows a decrease of 3,338 messages containing 429,131 words.

The LePas and Port Nelson stations (operated for the Department of Railways and Canals by this Department) handled 7,617 messages containing 570,281 words, an increase of 2,358 messages containing 244,320 words:

Table I shows a comparative statement of the business handled by the different systems during the last six years.

Table No. 1. Comparative Statement of Business handled by the Radiotelegraph Systems during the last Six Years.

Service	1910-11		1911-12		1912-13		1913-14		1914-15		1915-16		Comparison with 1914-15		
	Mes- sages.	Words.	Mes- sages.	Words.	Mes- sages.	Words.	Mes- sages.	Words.	Mes- sages.	Words.	Mes- sages.	Words.	Increase or Decrease.	Mes- sages.	Words.
East Coast.	71,594	1,179,434	119,049	1,824,450	153,843	2,704,411	145,605	2,443,145	59,846	1,196,512	45,195	864,020	Decrease	14,651	332,492
Great Lakes.	Nil.		1,043	17,095	2,750	52,422	9,601	219,786	15,785	326,505	13,617	259,366	Decrease.	2,168	67,149
West Coast	48,074	647,461	76,158	997,900	115,494	1,518,926	157,354	2,206,331	98,386	1,532,526	95,048	1,103,395	Decrease.	3,338	429,131
Hudson Bay.									5,259	325,961	7,617	570,281	Increase	2,358	244,320
Totals.	119,668	1,826,895	196,250	2,839,445	272,087	4,275,759	312,560	4,869,262	179,276	3,381,504	161,477	2,797,062	Net Decrease.	17,799	584,442

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REVENUE.

The total revenue collected during the year amounted to \$8,494.99 against \$11,738.35 in 1914-15. The West Coast service shows a decrease of \$3,934.94, the Great Lakes a decrease of \$7.76, and the East Coast an increase of \$699.34.

TABLE No. 2.—Comparative Statement of Revenue received by the Coast Stations Services during the past Seven Years.

	1909-10.	1910-11.	1911-12.	1912-13.	1913-14.	1914-15.	1915-16.
	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.
East Coast.....	Nil.	Nil.	229 57	475 00	318 42	322 99	1,022 33
Great Lakes.. . . .	Nil.	Nil.	Nil.	17 08	27 55	85 92	78 16
West Coast.....	Nil.	3,108 63	4,484 77	9,928 40	15,992 70	11,329 44	7,394 50
Totals.. . . .	Nil.	3,108 63	4,714 34	10,420 48	16,338 67	11,738 35	8,494 99

TABLE No. 3.—Detailed Statement of Business handled by the Ten Stations on the Pacific Coast owned and operated directly by this Department.

Name of Station.	Private Business to and from Ships.		Private Business between Stations.		Business to and from Government Ships.		Government business between Stations.		Service Messages.		Retransmitted Messages.		Cost of Maintenance.	Revenue.
	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.	\$	cts.
Gonzales Hill (Victoria).	1,259	21,408	6,145	90,044	772	26,804	7,977	116,194	17,313	161,668	350	6,121	4,115	1,810
Pachena Point.	87	1,317	21	289	146	4,462	426	1,379	1,902	15,570	181	2,554	3,580	43
Estevan Point.	1,380	17,547	21	520	413	12,669	407	1,856	3,254	27,903	11,942	142,039	4,662	1,508
Dead Tree Point.	4	40	1,284	30,514	4	193	4	86	2,029	17,506			2,265	413
Ikeda Head.	13	131	191	2,537	15	452	14	207	1,599	12,613	162	1,916	2,078	86
Triangle Island.	1,121	16,678	113	2,604	94	2,567	785	5,441	4,672	40,978	8,756	94,668	5,084	923
Point Grey.	254	3,856	718	11,065	62	1,467	487	2,536	2,820	21,334	678	2,400	3,594	340
Digby Island (Pr. Rupert)	912	12,066	3,379	57,147	213	9,594	1,408	10,414	2,672	23,751	4	37	4,331	1,429
Cape Lazo.	616	9,021	63	845	148	6,934	385	837	2,456	19,747	160	2,811	3,381	347
Alert Bay.	236	3,500	492	7,163	54	2,533	43	783	1,929	14,009	3	70	3,407	491
District office at Victoria														
General Account (including charter of steamers)														
Esquimalt Workshop, etc.														
Totals..	5,882	85,564	12,427	202,728	1,921	67,675	11,936	139,733	40,646	355,079	22,236	252,616	47,048	7,394

Total number of messages handled. 95,048
Total number of words handled. 1,103,395
Total cost of maintenance of stations (including office, workshop, etc.). \$ 17,048 07
Total revenue. 7,394 50

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TABLE No. 4.—Detailed Statement of Business handled by the Eight Stations on the Great Lakes, owned by the Department of the Naval Service, and operated by the Marconi Wireless Telegraph Company of Canada, Limited.

Name of Station.	Private Business to and from Ships.		Private Business between Stations.		Business to and from Government Ships.		Government business between Stations.		Service Messages.		Retransmitted Messages.		Cost of Maintenance.		Government percentage of Revenue.	
	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.	\$	cts.	\$	cts.
Port Arthur...	863	13,261	12	203	220	3,926	1	15	327	3,404	101	1,889	3,500	00		12 74
Sault Ste. Marie...	1,289	20,503	8	86	402	10,506	7	105	257	7,800	650	12,643	3,500	00		11 02
Tobermory...	228	4,154	76	1,111	222	6,399	2	45	666	5,770	775	18,050	3,500	00		3 14
Midland...	447	9,606	32	425	222	6,010			246	3,980	231	4,968	3,500	00		9 19
Point Edward...	440	8,096	51	1,049	133	4,597	1	20	470	6,814	1,173	28,551	3,520	65		17 24
Port Burwell...	348	3,531	20	396	97	2,260	3	177	127	2,183	17	512	3,641	30		6 07
Toronto...	614	9,931	21	267	80	1,769			2,646	51,463	66	1,526	3,500	00		16 64
Kingston...	26	1,365											3,522	57		2 12
Total...	4,255	70,447	220	3,537	1,376	35,467	14	362	4,739	8,144	3,013	68,139	28,184	52		78 16

Total number of messages handled.....	13,617
Total number of words handled.....	259,366
Total cost of maintenance.....	\$ 28,184 52
Total revenue.....	78 16

Table No. 5. Detailed Statement of Business handled by the Twenty Stations in the Gulf and River St. Lawrence and East Coast, owned by this Department and operated by the Marconi Wireless Telegraph Company of Canada, Limited, under contract.

Name of Station.	Private Business to and from Ships.		Private Business between Stations.		Business to and from Government Ships.		Government business between Stations.		Service Messages.		Retransmitted Messages.		Cost of Maintenance.		Government percentage of Revenue.	
	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.	\$	cts.	\$	cts.
Cape Sable.																
Partridge Island (St. John N.B.).	430	7,070			593	14,124	59	833			156	3,718	1,010	46		
Cape Race.	5,002	91,441	10	183	1,186	23,141	44	954	18	354	24	728	3,500	00		
Grindstone Island	39	762	2,039	45,479	1,147	2,666	4	70	520	8,562	11	272	3,500	00		
Cape Bear.	7	113	59	1,825	554	12,137	161	2,148	264	4,381	911	14,590	1,200	00		
Point Riche	26	815	10	148	167	3,153	23	251	185	3,029	1,849	60,044	2,500	00		
Point Amour	1	8	382	6,138	55	933	300	2,780	68	738	202	2,513	3,837	48		
Belle Isle*.			37	650	21	315	724	31,994	199	4,219	1,411	20,314	3,500	00		574 57
Cape Ray.	318	4,475	278	4,098	588	10,903	911	4,853	278	6,473	4,303	60,969	4,500	91		
Harrington.							75	1,340	387	6,464	485	9,009	3,515	50		
Heath Point.	22	563	111	1,861	117	2,388	233	2,241	299	7,807	4,938	86,626	2,761	34		
Fame Point	317	6,445	693	13,911	508	11,601	372	6,517	851	15,970	47	1,117	3,500	00		
Clarke City																
Father Point	339	5,388	1	25	264	6,763	2	18	33	541	15	591	3,756	50		
Grosse Isle.			19	308	316	4,469	277	3,792	6	160	49	1,309	2,901	50		
Quebec.	340	5,595			1,524	10,572	461	13,127	158	3,502	72	1,586	2,881	50		
Three Rivers	35	695			206	5,086			28	294	434	10,270	3,500	00		
Montreal.	253	4,429			19	365			154	2,819	7	148	3,756	50		33 88
Sable Island	3	135	13	286	49	871	505	4,560	258	3,564	192	3,725	3,319	69		347 28
Camperdown (Halifax)	518	10,397	21	414	1,171	30,914	705	7,725	211	3,815			4,692	98		
Totals.	7,650	138,331	3,673	75,326	7,485	140,401	4,856	83,203	3,917	72,692	15,107	277,229	65,136	36		955 73

Total number of messages handled.....	42,688
Total number of words handled.....	787,182
Total cost of maintenance.....	\$ 65,136 36
Total Revenue.....	955 73

*Includes returns from 1st April, 1915, to 30th November, 1915, only.

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TABLE No. 6.—Detailed Statement of Business handled by the Two Stations on the East Coast owned and operated by the Marconi Wireless Telegraph Company of Canada, Limited, under contract with the Department of the Naval Service.

Name of Station.	Private Business to and from Ships.		Private Business between Stations.		Business to and from Government Ships.		Government business between Stations.		Service Messages.		Retransmitted Messages.		Cost of Maintenance.	Revenue.
	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.	\$ cts.	\$ cts.
North Sydney..	83	1,224			288	4,370	144	1,951	65	816	14	292	1,153 56	66 60
Pictou..	65	917	773	39,668	554	12,160	78	1,270	350	12,220	93	1,950	1,850 00	
Total...	148	2,141	773	39,668	842	16,530	222	3,221	415	13,036	107	2,242	3,003 56	66 60

Total number of messages handled....	2,507
Total number of words handled....	76,838
Total cost of maintenance.	\$ 3,003 56
Total Revenue.....	66 60

TABLE No. 7.—Detailed Statement of Business handled by LePas and Port Nelson Radiotelegraph Stations owned by the Department of Railways and Canals.

Name of Station.	Private Business to and from Ships.		Private Business between Stations.		Business to and from Government Ships.		Government business between Stations.		Service Messages.		Retransmitted Messages.	
	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.	Messages.	Words.
LePas			954	16,255			2,356	254,855	441	7,704		
Port Nelson	18	433	953	16,177	96	12,214	2,356	254,855	442	7,710	1	7
Totals.		18 433	1,907	32,432	96	12,214	4,712	509,710	883	15,414	1	7

Total number of messages handled.....

7,617

Total number of words handled.....

570,281

The cost of maintenance of these stations is borne by the Department of Railways and Canals and all revenue accrued to that Department.

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EXAMINATION FOR CERTIFICATES OF PROFICIENCY IN RADIOTELEGRAPHY.

A total of 107 operators were examined during the year, including 42 re-examinations; 52 candidates were successful and 55 failed.

The following list shows the names of the successful candidates for certificate of proficiency in radiotelegraphy:—

Number of Certificate.	Date of Certificate.	Name.	Grade of Certificate.	Where Examination held.
90.....	April, 21st 1915.	Taylor Fred.....	1st Class.....	Toronto, Ont.
91.....	" 16th 1915.	Lister, W. K.....	1st Class Ship.....	Victoria, B.C.
92.....	" 16th 1915.	Holmes, J. J.....	1st ".....	Victoria, B.C.
93.....	" 21st 1915.	Wilkie, A. H.....	1st ".....	Toronto, Ont.
94.....	" 21st 1915.	Lindsay, C. C.....	1st ".....	Toronto, Ont.
95.....	" 21st 1915.	Laurie, W. L.....	1st ".....	Toronto, Ont.
96.....	" 21st 1915.	Paterson, F. G.....	1st ".....	Toronto, Ont.
97.....	" 21st 1915.	Galbraith, R. A. H....	1st ".....	Toronto, Ont.
98.....	" 21st 1915.	Russell, A. H. K.....	1st ".....	Toronto, Ont.
99.....	" 30th 1915.	McKinnon, A.....	1st ".....	Ottawa.
100.....	" 30th 1915.	Barnes, W. S.....	2nd ".....	Ottawa.
101.....	" 26th 1915.	McIntyre, C. M.....	1st ".....	Victoria, B.C.
102.....	May 8th 1915.	Anderson, J. L.....	1st ".....	Victoria, B.C.
103.....	" 12th 1915.	Lovlee, R. P.....	1st ".....	Victoria, B.C.
104.....	June.. 7th 1915.	Argyle, J. V.....	1st ".....	Victoria, B.C.
105.....	July 6th 1915.	DesLauriers, H. E....	1st ".....	Ottawa.
106.....	" 19th 1915.	Barnsley, Jack.....	1st ".....	Victoria, B.C.
107.....	" 19th 1915.	Olson, J. E. H.....	1st ".....	Victoria, B.C.
108.....	" 10th 1915.	Crawford, J. A.....	1st ".....	Victoria, B.C.
109.....	" 19th 1915.	Calverley, W.....	1st ".....	Victoria, B.C.
110.....	Aug. 30th 1915.	Muir, C. A.....	1st ".....	Ottawa.
111.....	July 26th 1915.	Sheepwash, W. J.....	1st ".....	Victoria, B.C.
112.....	Sept. 7th 1915.	Hill, A. P.....	1st ".....	Victoria, B.C.
113.....	" 7th 1915.	Adams, William.....	1st ".....	Victoria, B.C.
114.....	Oct. 4th 1915.	Campbell, R. A.....	1st Class Coast and Ship..	Halifax, N.S.
115.....	Nov. 15th 1915.	Ward, W. E.....	1st Class Ship.....	St. John, N.B.
116.....	" 17th 1915.	Sullivan, W. J.....	1st ".....	St. John, N.B.
117.....	Dec. 1st 1915.	Armstrong, W. L.....	1st ".....	Victoria, B.C.
118.....	" 1st 1915.	Unwin, A.....	1st ".....	Victoria, B.C.
119.....	" 13th 1915.	Russell, R. V. H.....	1st ".....	Halifax, N.S.
120.....	" 13th 1915.	McDougall, E. W.....	1st ".....	Halifax, N.S.
121.....	" 13th 1915.	McAdam, W. J.....	1st ".....	Halifax, N.S.
122.....	" 13th 1915.	Hassell, W. G.....	1st ".....	Halifax, N.S.
123.....	" 16th 1915.	Cooper, E. W. A.....	1st ".....	Victoria, B.C.
124.....	" 22nd 1915.	Parkin, W. L.....	1st ".....	Victoria, B.C.
125.....	Jan. 12th 1916.	Gagnon, C. H.....	1st ".....	Victoria, B.C.
126.....	" 20th 1916.	Burgess, W.....	1st ".....	Halifax, N.S.
127.....	" 13th 1916.	Ward, V. H.....	1st ".....	Halifax, N.S.
128.....	" 13th 1916.	Rushbrook, S. H.....	1st Class Coast and Ship..	Halifax, N.S.
129.....	" 20th 1916.	Gale, G.....	1st Class Ship.....	Halifax, N.S.
130.....	" 13th 1916.	Hillyer, L. A.....	1st ".....	Halifax, N.S.
131.....	" 25th 1916.	Brannen, H. H.....	1st ".....	Halifax, N.S.
132.....	" 19th 1916.	Parent, J. G.....	1st ".....	Halifax, N.S.
133.....	" 18th 1916.	Brown, W. A.....	1st Class Coast and Ship..	Halifax, N.S.
134.....	Feb. 24th 1916.	Garner, E.....	1st Class Ship.....	Halifax, N.S.
135.....	" 17th 1916.	Bragg, J. F.....	1st ".....	Halifax, N.S.
136.....	" 25th 1916.	Theriault, A. J.....	1st Class Coast and Ship..	Ottawa.
137.....	" 23rd 1916.	Graves, E. L.....	1st Class Ship.....	Victoria, B.C.
138.....	March 6th 1916.	Caesar, T. P.....	1st ".....	Halifax, N.S.
139.....	" 6th 1916.	Foote, G. C.....	1st ".....	Victoria, B.C.
140.....	" 22nd 1916.	Welsman, T. S.....	1st ".....	Toronto, Ont.
141.....	" 22nd 1916.	Duncan, W. C. C.....	1st Class Coast and Ship..	Toronto, Ont.

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The following holders of certificates of proficiency in radiotelegraphy passed a successful examination in the operation of other equipments and have had their original certificates amended accordingly.

Certificate Number.	Name.	Additional Equipment.
114.	Campbell, R. A.....	1.7 K.W. and 0.5 K.W. Ship and 2 K.W. Coast Stations.
115.	Downer, J. H.....	1.5 K.W. Ship Station.
118.	Fenwick, J. R.....	1.5 K.W. Ship Station.
119.	Russell, R. V. H.....	1.7 K.W. Ship Station.

ASSISTANCE RENDERED TO SHIPS DURING THE YEAR BY THE GOVERNMENT RADIOTELEGRAPH SERVICE.

West Coast.

SS. Princess Maquinna.—On the 11th July, 1915, the ss. *Princess Maquinna* stranded opposite the North Pacific cannery in the Skeena river, but refloated at full tide at 11.45 p.m. Messages were exchanged during the time the vessel was ashore between the captain and the agents at Prince Rupert and Victoria, via the Digby Island station.

SS. Mariposa.—On the 8th October, 1915, the ss. *Mariposa* was wrecked on Pointers island at 5 a.m. Communication with the *Mariposa* was made by the Triangle Island station through the ss. *Despatch*. At 8 a.m. the *Despatch* reported that she had reached the wreck at 7.43 a.m. and launched boats at 7.45 a.m. and that they were then picking up all the passengers from the beach. At this time the *Mariposa* had a bad list, the forward hold being full of water and all fires out. At 9.45 a.m. the *Despatch* had all the *Mariposa's* passengers aboard and sailed for Ketchikan. Constant wireless communication was maintained throughout by the Triangle Island station.

SS. City of Seattle.—On the 12th November, 1915, a message was received from the *SS. City of Seattle* at 5.45 a.m. advising that she would arrive at Prince Rupert at 9 a.m. An answer was sent to this message by the Digby Island station to which no reply was received; fifteen minutes later the *City of Seattle* ran ashore at Evening point, Granville channel. The Digby Island station called the boat repeatedly during the morning, but no reply was received from her.

SS. Princess Maquinna.—On the 1st February, 1916, the *SS. Princess Maquinna*, southbound from Prince Rupert, struck on Maud island, Discovery passage, at 1. a.m. The commander made all speed to Menzie's bay, where the vessel was beached. The Cape Lazo station was in constant communication with the *SS. Princess Maquinna*, and messages were exchanged between the captain of the vessel and her owners at Victoria without interruption or delay. The wrecking steamer *Salvor* was despatched to the assistance of the *Princess Maquinna*, but the latter vessel eventually refloated and proceeded to Victoria under her own steam.

SS. Camosun.—On the 7th March, 1916, the *SS. Camosun* advised the Digby Island station at 5.15 a.m. that she was ashore 2 miles north of Lima point, Digby island. The *Camosun* had left Prince Rupert the previous night at 10 o'clock en

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route for Massett, and was returning for shelter when she went ashore in a blinding snowstorm. The local agent of the Union Steamship Company was immediately advised of the accident, and by 6 a.m. both the SS. *Prince John* and SS. *Princess Sophia* were ready to render any assistance required. The *Camosun's* passengers were taken off by a tug and the SS. *Salvor* was ordered to proceed to the scene of the accident in order to pull the *Camosun* off.

East Coast.

SS. *A. W. Perry*.—On the 8th June, 1915, the SS. *A. W. Perry* went on the rocks outside Halifax harbour during very foggy weather. The steamer sent out signals of distress which were immediately answered by the Camperdown station, and the C.G.S. *Premier*. The whole of the passengers and crew were saved, about sixty persons in all.

Unsuccessful attempts were made to refloat the vessel.

Great Lakes.

The radiotelegraph stations on the Great Lakes were not called upon to render any assistance to distressed vessels during the year.

NEW CONSTRUCTION, ADDITIONS AND ALTERATIONS.

East Coast.

Point Riche.—The transmitting range of the Point Riche station was improved by the installation of new apparatus, at a cost of \$409.94.

North Sydney.—The power of the North Sydney station has been increased by the installation of new transmitting apparatus of 2 k.w. power. The set operates from the local power supply, and a musical spark is obtained by means of a non-synchronous disc discharger. The total cost of the installation amounted to \$906.79.

Great Lakes.

No construction was undertaken on the Great Lakes during the year.

West Coast.

Alert Bay.—The masts and hoist engines were thoroughly overhauled. The 8-horsepower engine was fitted with high-tension ignition system and both engines fitted with the central oiling system.

Cape Lazo.—A new aerial was erected at this station. The second engine was fitted with high-tension ignition system and central oiling system.

Dead-Tree Point.—Masts and station thoroughly overhauled. A new disc was installed and transmitting gear rearranged in the engine room.

Digby Island.—Masts, hoist engine, and station overhauled. A further ground connection was installed and connected up the existing ground system. A new receiver was put in, and both engines fitted with the central oiling system.

Estevan.—The 1-k.w. set has been refitted and a new receiver supplied. Both engines have been equipped with high-tension ignition system and central oiling system.

Gonzales Hill.—A new transformer was installed increasing the power at the station from 3 to 5 k.w. Station was overhauled generally and a new receiver supplied.

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Ikroda.—Masts, tramway, hoist, and station generally thoroughly overhauled. Both generators were fitted with synchronous discs, and the transmitting gear rearranged.

Pachena.—The tree mast was cleaned down and fitted with stays, and a top-mast and yard erected. The standard mast was thoroughly overhauled. A synchronous disc was fitted to the 2-k.w. set. Both engines have been equipped with high tension ignition system and central oiling systems.

Triangle Island.—Masts and station were thoroughly overhauled. Both generators have been fitted with synchronous discs and the transmitting gear re-arranged and a new receiver installed. The two engines have been fitted with the central oiling system.

HUDSON BAY AND STRAIT.

The schooner *Burleigh* was outfitted and took a load of cement and lumber and a construction gang of twenty men to start work on the new radiotelegraph station on Mansel island. The schooner arrived at the island on the 19th of August and left again on the 18th September, 1915. The eight mast anchors and building foundations were installed (approximately 270 yards of concrete) and construction shacks were erected to accommodate a gang of fifty men.

Everything is now in readiness to proceed with the erection of the building and masts. It is estimated that the installation will take sixty working days to complete, provided reasonable weather is encountered when erecting the two 300-foot towers. When completed, the Mansel Island station will communicate with the outside world via the station at Port Nelson, Man. The latter station is owned by the Department of Railways and Canals, and communicates with a similar station located at Le Pas, Man., at which point connection is made with the Great North Western Telegraph system. Both the Port Nelson and Le Pas stations are operated by the Department of the Naval Service on behalf of the Department of Railways and Canals.

CRUISE OF THE SCHOONER "BURLEIGH."

Outward voyage.—The departmental three-masted schooner *Burleigh*, 149 tons, equipped with 40-horsepower gasoline auxiliary, left Halifax on the 20th July, 1915, for Mansel island (at the western entrance to the Hudson strait), taking a gang of twenty-four men and material to commence work on the radiotelegraph station which will be established on the above island.

The schooner arrived off cape Chidley (the eastern entrance to Hudson strait) sixteen days later (5th August), and ran into heavy ice; no progress was made for three days owing to ice and strong currents. On the 8th August the ice eased up, and she continued through the strait. Loose ice was prevalent across the mouth of Ungava bay, but not sufficient to seriously delay progress. No ice was encountered after the vessel was half-way through the strait, and she finally arrived at Eric cove (at the western entrance to the strait) on the 17th August.

It will be noted that the vessel took ten days to get through the strait. This, however, was more due to prevailing head winds than to ice; the time lost on account of the latter is estimated at three to four days.

The auxiliary power on the *Burleigh* is inadequate, the same not being powerful enough to drive her against even a moderate head wind.

Mansel Island.—The *Burleigh* arrived at Mansel island on the 18th of August, and was moored in the cove at the north end of the island. The party remained there until the 15th September. During this period snow squalls were encountered on the 24th and 29th of August, and 13th and 17th of September, respectively, but snow did not fall in any quantity; the temperature varied between 32° and 35° F.,

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rising at times as high as 40°. The night temperature was much the same as the day. There were very few calm days, the usual weather being strong breeze to moderate gale, and for three days there was one heavy gale.

Return Voyage.—On the return voyage the *Burleigh* left Mansel island on the evening of the 18th September, cleared cape Chidley early on the morning of the 24th (5½ days), arriving at Halifax on the 5th October.

During the return voyage through the strait no ice was encountered or sighted, with the exception of one large iceberg in Ugava bay, and very little snow. The greater part of the mainland was, however, covered with snow.

OPERATORS.

In view of the importance of the work in which the government wireless operators are engaged, the confidential nature of the messages passing through their hands, and the secret instructions with which they must be entrusted, it was considered advisable to enlist in the Royal Naval Canadian Volunteer Reserve, all the wireless operators in the employ of the Department of the Naval Service.

A rating as "wireless operator" has therefore been instituted in the Royal Naval Canadian Volunteer Reserve, and authorized by Order in Council P.C. 162, dated the 29th January, 1916. The following regulations for the government of the rating have been established:—

WIRELESS OPERATORS.

Regulations for the institution and government of the rank of wireless operator R.N.C.V.R., authorized by Order in Council P.C. 162, dated January 29, 1916.

Wireless Operators:

- (1) A rank in the R.N.C.V.R. to be known as "wireless operator" is hereby established.

Period of Enlistment:

- (2) Wireless operators will be required to enlist in the R.N.C.V.R. for a period not exceeding the duration of the war.

Grades:

- (3) The following grades of wireless operators are established:—Chief W/T operator, First class W/T operator, Second class W/T operator, Third class W/T operator, Fourth class W/T operator, learner.

Rank:

- (4) Chief W/T operators will rank as non-executive chief warrant officers. Remaining grades of W/T operators will rank as non-executive warrant officers. W/T operators will take precedence similar to corresponding rank of non-executive warrant officer in the Royal Canadian Navy, but junior to those ranks.

Rates of Pay:

- (5) Rates of pay for W/T operators will be as follows:—

	Per Month.
Chief W/T operator.. . . .	\$ 62 50
First class W/T operator.. . . .	55 00
Second class W/T operator.. . . .	50 00
Third class W/T operator.. . . .	45 00
Fourth class W/T operator.. . . .	40 00
Learner.. . . .	20 00

Special Allowances:

- (6) W/T operators whilst acting as "officers in charge" will receive special allowance as follows:—

	Per Month.
First class station.. . . .	\$ 15 00
Second class station.. . . .	10 00
Third class station.. . . .	5 00
Ship station.. . . .	5 00

- (7) The Minister is also authorized to establish special additional allowance in the case of operators attached to specially isolated stations, such as those of the Hudson Bay division, etc.

Lodging, Provisions, Fuel and Light Allowance:

- (8) When lodging, provisions, fuel and light are not supplied by the Department, the following allowances will be made;

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East Coast.

	Per Month.
Provisions..	\$ 20 00
Lodging, fuel and light..	7 50
Consolidated..	\$ 27 50

West Coast.

	Per Month.
Provisions..	\$ 22 50
Lodging, fuel, and light..	8 00
Consolidated..	\$ 30 50

Travelling Expenses:

(9) W/T operators when travelling will receive sustenance allowance as follows:—

	24 hours.	9 hours.	Between 5 and 9 hours.
East coast..	\$2 50	\$1 25	\$0 75
West coast..	2 75	1 50	0 85

Uniforms:

(10) Free uniform and kit will be granted to every W/T operator on joining, as follows:—
2 monkey jackets, 2 waistcoats, 2 pairs trousers, 1 cap, 2 cap covers, 1 overcoat, 1 suit canvas
overalls.

Upkeep of Uniforms:

(11) An annual gratuity of \$37.50 will be allowed to each W/T operator for upkeep of kit.

Badges:

- (12) W/T operators' uniforms will bear the following distinction badges, according to class:
- | | |
|------------------------------|--|
| Chief W/T operator.. | Wings of Mercury, 1 R.N.C.V.R. stripe without
curl below. |
| First operator.. | Wings of Mercury, 3 stars, below. |
| Second operator.. | Wings of Mercury, 2 stars, below. |
| Third operator.. | Wings of Mercury, 1 star below. |
| Fourth operator.. | Wings of Mercury. |
| Learner.. | Wings of Mercury. |

The above to be gold badges placed on the sleeve, the Wings of Mercury to be half-way
between the elbow and the end of the sleeve; the cap badge to be the same as non-
executive warrant officer.

No Separation Allowance:

(13) No separation allowance will be made in the case of W/T operators.

Other Allowances:

(14) No allowances, other than those specifically provided for in this order, will be allowed.

TRANSPORTS.

Under an arrangement with the Admiralty, the department has equipped with
radiotelegraph apparatus all munition transports plying to Canada, and is supplying
operators and supervising the operation of the stations on their behalf.

PERSONNEL.

The personnel of the radiotelegraph service in the Dominion is as follows:—

	GOVERNMENT.				COMMERCIAL.			
	Head- quart- ers.	Coast Sta- tions.	Land Sta- tions.	Ship Sta- tions.	Head- quart- ers.	Coast Sta- tions.	Land Sta- tions.	Ship Sta- tions.
Engineers and officers in charge....	1	20	2	49	7	31	19	66
Operators.....		35	5	7		35	17	
Other employees.....	5	6	1		52	3	32	
Executive officials and inspectors..	3	2		1	2	3		
	9	63	8	57	61	72	68	66

Total personnel, 404.

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I am pleased to report that the staff directly in the employ of this department have taken great interest in their work and have carried out their duties in a satisfactory and efficient manner.

In addition to the work outlined in this report a very considerable amount of a confidential character has been undertaken in connection with the war.

It would be inexpedient to give details of the latter at the present time, although it comprised perhaps the major portion of the branch's activities.

I have the honour to be, sir,

Your obedient servant,

C. P. EDWARDS,

General Superintendent, Government Radiotelegraph Service.

